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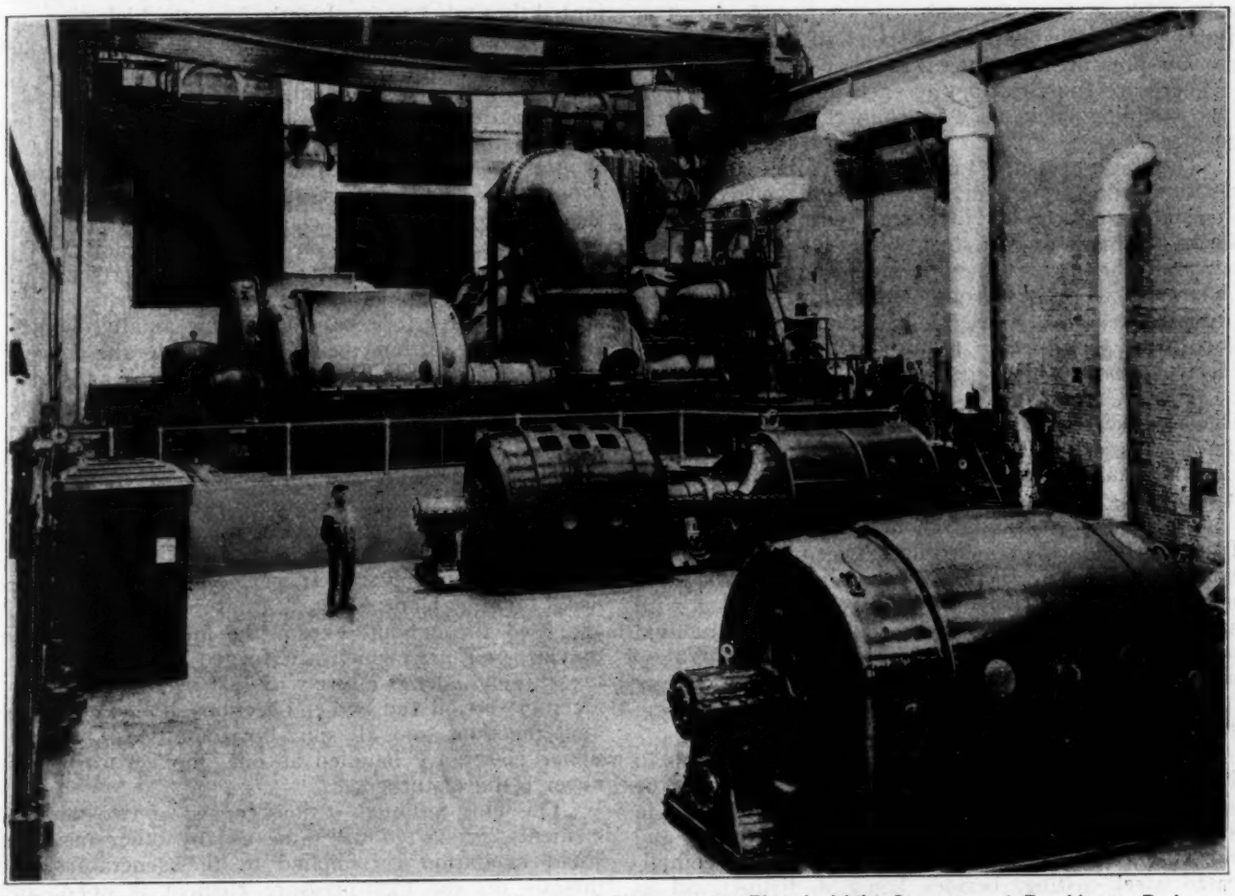

45,000-Kw. Westinghouse Turbogenerator Operating in Station of Narragansett Electric Light Company, at Providence, R. I.

The 45,000-Kw. Turbine-Generator Set at Providence

Huge Cross-Compound Unit of the Narragansett Electric Light Co.—Unique Features of the Two Turbine Elements

THE Narragansett Electric Light Co., at Providence, R. I., recently put into operation a 45,000-kw. turbogenerator unit. This machine is of the cross-compound double-unit type, consisting of a high and low-pressure turbine, each connected through a flexible coupling to its own generator, having a capacity of 22,500 kw., and mounted on separate bedplates supported on foundations lying parallel to each other. The generators are arranged to feed separately or together to the main bus.

This type of turbine is very successfully exemplified by the three 30,000-kw. units installed a few years ago in the 74th street station of the Interborough Rapid Transit Co., New York City, and which have attracted a great deal of attention.

DETAILS OF THE TURBINES.

Steam enters the high-pressure turbine through suitable governor-controlled valves, passes through this single-flow element, out through an exhaust on the top, and is conducted by means of a receiver pipe overhead to the middle of the double-flow low-pressure turbine alongside, where it divides, flowing in opposite directions through low-pressure blading, then down through the exhaust chambers into two Westinghouse LeBlanc jet condensers of the latest type.

The energy given up by the steam at full load is equally divided between the high- and low-pressure turbines, the generators dividing the load in half; at lower loads a greater proportion is carried by the high-pressure element.

The unit was designed to operate with a steam pressure at the throttle of 200 lb. with 100° F. superheat and a vacuum of 29 in. in the exhaust. The generators have a capacity of 23,750 kv-a., at 11,000 volts, 3-phase, 60 cycles and 0.95% power-factor. The high-pressure element has a speed of 1800 r. p. m., the low-pressure element of 1200 r.p.m.

There are four bearings to each unit, a flexible pin type coupling being used to connect the turbine and generator.

The high-pressure turbine is of the single-flow reaction type throughout, of simple, rugged construction; all parts coming in contact with high-pressure steam are made of cast steel, while the exhaust chamber and other parts not subjected to high temperature or stresses are of cast iron. The pressure in the high-pressure cylinder varies from a maximum of about 200 lb. at the inlet to atmospheric pressure in the receiver pipe at full load.

The high-pressure end, or steel part of the cylinder, is composed of two steel castings, 5 ft. 10 in. inside diameter and 1¾ in. thick, while at the joint thickness gradually increases until it merges into a flange 3 in. wide, tapering to the outer edge. The 2¼-in. diameter bolts are spaced about one-third of the way from the inside edge, and 6 in. between centers. These bolts, or studs, as they really are, are tapped alternately into upper and lower flanges registering with suitable bosses on the companion flange. This method permits of a closer spacing of bolts, removing less metal, and produces a stronger flange than by any other means. No gasket is used, the joint being scraped to a surface.

The four rings containing the blades are not an integral part of the main cylinder, but are made of separate castings jointed in the middle, resulting in simplicity of construction, freedom from strains, and the absence of those difficulties inherent in a complicated steel casting, besides being a distinct aid in manufacturing as the machine work is not all done on one piece, but can be divided among different machines, and finally assembled when each piece is completed. These rings are clamped in place, again saving expensive work on the main castings.

The high-pressure cylinder is supported on three points, one under the governor, or thrust end, and one on each side of the exhaust, near the center line, thus insuring against distortions, or a possibility of misalinement, due to differential expansions between the turbine and generator supports from unequal temperatures.

The high-pressure spindle consists of a hollow steel drum about 3 ft. in diameter, carrying most of the blading, there being two blade rings of larger diameter on the one end, and corresponding dummy rings, or balance pistons, on the other. The spindle ends are pressed into the drum and are secured with tee-headed shrink links, which are themselves held in place by the blade and dummy rings. The spindle parts are made from ordinary carbon steel. There are 24 rows of blades in the high-pressure turbine, ranging in size from 1-in. blades, 4 in. long, to 1¼-in. blades, 9½ in. long. These blades are unusually strong and rugged. The maximum mean blade speed is 470 ft. per second.

The steam passes out through an exhaust at the bottom of the cylinder into a 66-in. receiver pipe leading over to the low-pressure turbine. A similar exhaust which connects through an automatic relief valve to the atmosphere is provided directly below. A gate valve is placed in the receiver pipe, in case it is necessary to operate either turbine alone, the high-pressure turbine running non-condensing, under control of its own governor, or the low-pressure turbine, on steam admitted through a 14-in. throttle from the high-pressure line. This is connected in step electrically with some other unit in the system.

The low-pressure element is of the straight double-flow reaction type. The steam entering at the top through the above mentioned receiver pipe, passes around the spindle in an annular chamber of ample proportions, and enters the low-pressure blading, there being 8 rows in each end, ranging from ¾-in. blades 6 in. long, to 1¼-in. blades 18 in. long. The low-pressure cylinder rests on four supports applied near the center line on each side of the exhaust chambers. It is free to expand by sliding axially on these supports, the turbine being anchored to the inboard generator pedestal. A system of radial and axial stays in the exhaust chamber produces extreme rigidity, minimizing the possibility of distortion, or sympathetic vibrations.

The low-pressure spindle is composed of a central hollow drum, rigidly secured to the spindle ends. Upon each of these ends are mounted two disks carrying the low-pressure blades, the maximum mean velocity of which is only 515 ft. per second. Cast steel is used for the blade rings. Phosphor-bronze blades are used throughout, except the last three rows in the low-pressure, which are forged steel. The low-pressure cylinder is entirely of cast iron, composed of a center section and two end sections, bolted and spigoted together, and all split horizontally. The three upper pieces are handled as one, the vertical points never being disturbed.

This unit, although it does consist of two separate elements, is started the same as any other machine. Field excitation is supplied to the generators, the throttle on the high-pressure element is open, and slowly brought up to speed, the low-pressure generator operating as a motor, and coming to speed in step with the other. The two machines as a unit can then be synchronized, and placed on the line, remaining in step, and properly dividing their load.

Condenser Equipment.

The condenser equipment for the above turbine consists of the largest condensing apparatus in the world. The condenser unit is composed of two separate and distinct low-level jet condensers, which can be operated together, or separately, if necessary. If the temperature of the injection water is low enough to warrant it, a workable vacuum can be maintained by only one condenser. These condensers are connected to form a single condensing apparatus by means of an exhaust connection, ample in area to permit operating either condenser alone, when necessary.

The same water level is maintained in each condenser by the use of a water-equalizing connection between one pump body and the other. This is an absolutely necessary feature, and it is provided in order to maintain a constant submergence over the center line of each pump, to provide sufficient head to force water into the runner under vacuum. This water-equalizing connection is so constructed that no

s occur between the condensers, it being made in the form of a toe, the bottom of which forms a reservoir. A baffle running almost to the bottom prevents surging. An air-equalizing connection is provided to maintain the same air pressure in each condenser. If both are in operation, the valve may be either open or closed, but it has been found by trial that if only one condenser is in operation, the valve must be open in order to have the same air pressure in each.

The condensers are equipped with geared turbine-driven pumps, running at 500 r. p. m. instead of 700 r. p. m., which latter is standard. This was necessary owing to the limited headroom in the basement. These pumps are able to operate with a submergence of 50 in. above the center line of the pump shaft, while 72 in. is necessary with a 700 r. p. m. pump. This resulted in a saving in headroom of 22 in.

In starting up this condenser it is necessary to use a priming pump. The main turbine is operated non-condensing, or with a slight vacuum, until sufficient vacuum is obtained for the condenser to lift its own water.

The Narragansett Electric Light Co. has found it convenient in winter time, when the temperature of the injection water is very low, to operate only one condenser of the twin outfit, and still maintain the vacuum desired, thereby cutting the cost of operation in half. In cutting the condensers out, it is only necessary to close the discharge and injection valves to the condenser not in operation and to operate the other independently.

The twin condensers used with the above 45,000-kw. turbine require 18,000,000 lb. of condensing water per hour, 9,000,000 lb. in each condenser. In addition to this 15 per cent more is required for the operation of air pumps.

BEACON LIGHTING EFFECT FOR TRAVELERS INSURANCE TOWER.

A Total of 56 Projectors to Produce Very Striking Beacon at 34th Floor Level.

One of the questions that has been a frequent subject of conjecture among watchers of the new building of the Travelers Insurance Co., Hartford, Conn., was answered a few days ago when it was learned there would be a beacon near the top of the tower which would rival in brilliance and radiative power the beacons in other of the world's famous tall buildings.

Plans relative to the lighting features of the Travelers tower have been made and unmade many times since the erection of the building was begun, but the plan of the beacon has been definitely settled upon. Anyone who can catch a glimpse of the work going on just above the limit of the stonework may see what is going to be put there.

Next above the limit of the stonework, at the thirty-fourth floor level, and below the gilded ironwork which surmounts the tower, there is being built a row of windows running in close continuity around the four sides of the superstructure. Each window is about 4 ft. high and 1 ft., 4 in. wide.

Suspended inside these windows will hang 36 400-watt projectors, 8 to each side and one in each corner, and 8 200-watt projectors, two in each corner on either side the large corner projector. These projectors will throw the light in every direction outward through the windows, so as to give the appearance of a continuous band of brilliant light circling the top of the tower and shining out from it.

Another feature of the tower lighting will be the illumination of the interior of the observation balcony by 12 hidden projectors. Current for all the projectors will be carried into the tower from the city lighting system. It is supposed that the beacon and balcony will be lighted every night, once they are ready for operation. From present appearances, it would seem that the work on the superstructure would not be completed for several weeks yet, possibly not until late summer or early autumn.

DEDICATION OF THE BUREAU OF MINES LABORATORIES.

New Laboratories, Shops and Experiment Station at Pittsburgh to Be Formally Dedicated.

The Bureau of Mines announces that during the week of Sept. 29 the new million dollar laboratories and workshops in Pittsburgh, Pa., will be formally dedicated. High officials of the Government, together with the governors of the principal mining states and the leaders in the mining industries and miners' organizations, will be present to take part in the dedicatory ceremonies. A feature of the dedication will be a great national Safety-First meet, teams of miners from all over the country competing for cups and medals. There will be contests in rescue and in first aid to the injured, and as there is immense rivalry between the teams of the different mining companies, it is expected that these contests will take at least two days for decision. On Sept. 30 the elimination contests will begin at Forbes Field in Pittsburgh, and will continue until only the winning teams are left for the final championship contests, which will take place on Oct. 1 immediately after the elimination trials are completed.

The different laboratories of the Bureau have been completely equipped for the investigation of the various problems relating not only to greater safety, but also to greater efficiency in the mining and metallurgical industries. Visitors will be invited to the electrical and mechanical workshops, and laboratories of the Bureau and also to the petroleum, gas and coal laboratories, the testing gallery of the mine safety section, and the industrial gas-mask division. Another point of interest will be the experimental mine of the Bureau at Bruceton, Pa., twelve miles from Pittsburgh, where an actual explosion of coal dust in the mine will be staged for the benefit of those attending. At the experimental station there is also to be shown a complete exhibit representing the mining and metallurgical industries of the country.

MORE SIGNS FOR SALINA.

Santa Fe avenue will assume the earmarks of Broadway on a small scale at the end of the calendar year, the Salina Light, Power & Gas Co., of Salina, Kansas, has announced, making public its plans for increasing the number of electric signs in the city.

Lamps totaling 29,500 burn in electric signs until midnight daily. The show windows over the city burn nightly 750,000 watts of electricity. The four-sided "Tea Table Flour" sign of the Weber Milling Corp., largest in the state, measuring 48 ft. by 38 ft. on each side, will be lighted shortly. The sign being erected for the Southwest Motor Car. Co. will be lighted in the near future.

Central-Station Rates in Theory and Practice

Second Article of Series—Cost Analysis of Electric Service —Energy Cost and Demand Cost — Some Features Determining Demand Cost—Load Curve and Load-Factor

By H. E. EISENMENGER

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This is the second article of a series to appear weekly throughout this volume. A general outline of the series was published in the issue of July 5 and the first article appeared in the issue of July 12. It gave a discussion of costs in general and introduced the subject of cost of electric service in particular. The present article begins the discussion of the three principal elements of this cost, which will be continued through several other installments before the subject of the price of the service (rates) can be intelligently taken up.

PART I.—THE COST OF ELECTRIC SERVICE—(Continued).

II-A. The Three Elements of Cost.

1. The Energy Cost.

SECTION 11. Every kilowatt-hour generated or delivered requires a certain amount of steam—at least in case of steam prime movers—and with that of fuel and water. In other words, the total costs of fuel and water increase with the number of kilowatt-hours generated and can be roughly set proportional to the latter so that we have a fixed unit cost of fuel and of water per kilowatt-hour. The items of fuel and water do not appear in hydroelectric plants; but in all central stations, whatever their prime motive power be, we have the cost of lubricating oil which increases with the size of the generator running, with the number of generators running and with the number of hours they are running. In other words, for a given central station the cost of the lubricating oil increases with the number of kilowatt-hours generated and can be roughly set proportional to the latter so that here too we have a fixed cost per kilowatt-hour. The same applies to the cost of attendance to the generators and the switchboards, to repairs and a number of other items.

This part of the cost, the energy cost, is also called sometimes, though not entirely correctly, the operating cost. We will see that a part of the real operating cost may belong to the "demand cost" (to be discussed in Section 24) and, conversely, the kilowatt-hour cost includes costs which are not operating cost. But, on the whole, roughly speaking, the kilowatt-hour cost and the operating cost are more or less identical.

12. As indicated previously in the example of the letter carrying service, we can establish a distinction in the amount of the energy cost per kilowatt-hour between various classes of customers. The most important one of the possible subdivisions into classes would probably be according to the distance of the customer's location from the generating station, inasmuch as generally a larger portion of the energy is lost in transmission if the energy has to be transmitted over a greater distance. We would be justified in saying that those customers who are located further away from the generating station cause a greater energy cost per kilowatt-hour than those who are located nearer the station and we might find the numerical values by methods similar to those to be shown later. But this distinction according to the location is rarely, if ever, made in practice.

Other variations in the amount of the energy cost per kilowatt-hour will be mentioned later (especially in Section 53) after the necessary fundamentals (load-factor, diversity-factor, etc.) have been discussed.

13. Let it be stated here—although that statement ought to be unnecessary for the careful reader—that the "energy cost" or "kilowatt-hour cost" is something entirely different from the "cost per kilowatt-hour." The cost per kilowatt-hour is the total annual cost of the central station divided by the number of kilowatt-hours generated (or delivered, or sold, as the case may be) anually, and is given in *dollars per kw-hr.* or *cents per kw-hr.* The kilowatt-hour cost (or energy cost), on the other hand, is a certain portion of the central station's total annual cost, corresponding roughly to the annual operating cost. It is given in *dollars per year.* Usually we reduce the kilowatt-hour cost to the kw-hr. generated or sold annually and thus arrive at the *kw-hr. cost per kw-hr.* or *energy cost per kw-hr.*, which is given in dollars per kw-hr. or cents per kw-hr. The kw-hr. cost per kw-hr. is a fraction of the total cost per kw-hr. By multiplying the kw-hr. cost per kw-hr. by the number of kw-hr. consumed annually by a certain consumer, we get the annual kw-hr. cost of that customer as a part of his total annual cost.

It is important to keep these distinctions between the kw-hr. cost and cost per kw-hr. in mind to avoid confusion.

2. The Demand Cost.

14. The second item to be discussed is the *demand cost*, that is, the part of the total cost which is practically proportional to the maximum demand in kilowatts or watts.

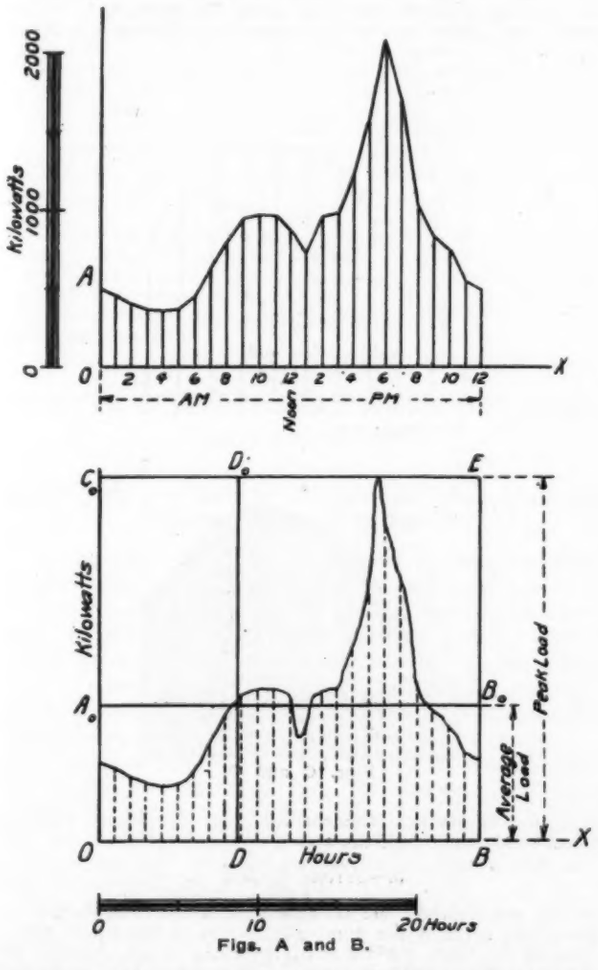
A. THE TOTAL DEMAND COST OF THE PLANT.

1. Capital Invested.

15. Suppose, for the sake of a simple example, that a central station has to deliver 24,000 kw-hr. a day with constant load on the generators all day; that means 1000 kw-hr. in any one-hour period of the day. To supply this, our generators, apparatus, lines, etc.,

have to have a capacity of 1000 kw. The load-factor[1] is 100%. If, however, these 24,000 kw-hr. would have to be delivered in six hours, for instance in the time between 4:00 p. m. and 10:00 p. m., again with constant load during these hours, the load of the central station will reach 4000 kw., because 4000 kw. × 6 hr. = 24,000 kw-hr. The capacity of the central station will, therefore, have to be four times as great as in the first case, or 4000 kw. instead of 1000[2]. Now a central station of 4000 kw. will cost, though not four times as much, still a good deal more than a 1000-kw. station. The same applies to the transmission and distribution lines, transformers, etc.

16. As a rough approximation we can say that the capital invested is proportional to the capacity of the central station in kilowatts. It should not be forgotten that this is an approximation. It is a well



Figs. A and B.

known fact that as the central station grows, the cost of the equipment per kilowatt goes down. Larger plants can use larger generating units than smaller plants and such units are not only cheaper to manufacture per kilowatt, but they occupy also less floor space per kilowatt, thereby reducing the cost of the building construction, etc., per kilowatt. The same applies to switching apparatus, etc. Moreover, even generating units of the same capacity have been becoming cheaper as the engineering sciences advance.

But as long as we remain within certain upper and lower limits of size near the present plant capacity, also when we do not apply our approximation over a period of too many years, we can assume the capital invested in the generating plant to be proportional to the capacity. If the central-station capacity has grown very much, especially if the manufacturing conditions have changed in the meanwhile, the factor of proportionality will have to be changed; there will be less capital invested per kilowatt in the generating station.

17. Similar considerations as have been explained for the cost of the power plant will also apply to the transmission lines, transformers, etc., so that we may say with a certain degree of approximation that the cost of these parts also is proportional to the peak load of the central station[3].

We thus arrive by a series of approximating assumptions at the result that the total capital invested in the generating plant, lines and transformers is proportional to the peak load of the central station[4].

Insert II—Appendix to Section 15.

Explanation of the Terms "Load Curve" and "Load-Factor."

A.—Load Curve.

Step off on a horizontal line *OX* in Fig. A, 24 equal sections, each one representing one hour of the day. From the end of every one of these sections draw a vertical line upwards and step off on these, beginning at their respective intersection with *OX*, the load in kilowatts of a certain central station at that particular hour, using some arbitrary scale, for instance 1 in. = 1000 kw. If, for example, at 12 o'clock midnight the load is 500 kw., step off ½ in. vertically from the point *O*, thus reaching point *A*. Do the same thing for every full hour of the day (1 o'clock, 2 o'clock, etc.). Joining the point at the upper end of each vertical with both its neighbors to the right and left by a straight line we get a continuous series of straight lines. We are not restricted to entering the loads at the full hours only. We can enter them in the same way for any intermediate time; as quarter hours, minutes, etc., and the series of lines will then more and more approach in any desired degree a steadily curved line (Fig. B).

This curve is called the *load curve* of the central station for the respective day. The load curve can, of course, also be extended over any other interval of time, but usually a 24-hour interval is chosen for reasons of convenient representation. This curve shows clearly at a glance how the load varies within the day. Where it is high above the horizontal axis *OX* the load is large and vice versa. The high parts of the curve are called the peaks and the low parts the valleys. The highest peak represents the peak load, hence the name of the latter.

In exactly the same manner we can draw a load curve for any individual customer or any group of customers.

The general shape of the diagram, Fig. B, is typical for what we can expect in an average central station on an ordinary winter day. Beginning at midnight we see the load is comparatively low, naturally so, because most of the customers have shut off their current entirely. The load is mostly street lighting and street-car service, provided that the latter is not furnished from the street-railway company's

[1] Readers who are not thoroughly familiar with the meaning of the terms "load-factor" and "load curve" should first read Insert II, which gives an explanation of these terms so essential for the understanding of the following sections.

[2] This is not strictly correct, since there must be a certain reserve capacity for breakdowns of a generator set, and the reserve capacity will obviously in general be a greater percentage of the total capacity where we have a small number of generating units than where we have a large one, that is, it will be in general a greater percentage for smaller capacities. But, as a whole, the approximating assumption that the capacity of a central station is proportional to the maximum load of the central station is justifiable.

[3] This implies an additional simplifying assumption, because it is evident that the cost of the lines and transformers depends also on local conditions, that is, on the location of the customers, etc., but, on the whole, in a given locality we can say that the variable portion of the cost of the lines and transformers will increase roughly in the same percentage as the maximum load on the central station.

[4] These assumptions are, briefly recapitulated, the following:
1. The capacity of the power house is proportional to the peak load.
2. The capital invested in the power house is proportional to the capacity of the power house.
3. The capital invested in the lines, transformers, etc., is proportional to the peak load.

These and the other approximations, to be discussed in the following, will be put together in diagrammatical form at the beginning of Insert IV—"Approximations."

separate power house. A few late birds who are still up at midnight go to bed by and by and the load reaches a minimum until the first early risers turn on their lights. The demand for this kind of lighting rises until daylight comes and then it may decrease. At that time, however, the factories begin to work, drawing a rather heavy power demand. Such stores and offices as need artificial illumination in daytime turn on their lights and thus we get an increase in the load during the earlier part of the forenoon. The motors in the factories which consume a considerable portion of the power generated are then shut off temporarily during the noon hour and accordingly we see a valley in the load curve at noon. At about 4 or 5 o'clock in the winter time the electric lights are turned on everywhere and we get the highest peak of the day. Soon after that time stores and offices close, causing a rapid falling off of the curve.

Of course the daily load curves of central stations differ from each other quite considerably according to the season of the year and to the local conditions[1].

The load curve gives us more information than simply whether the load at a particular time is high or low. The area under the load curve is a direct measure of the number of kilowatt-hours delivered, in other words, it is proportional to the energy delivered (or consumed, respectively). To understand this let us begin with a simple case. A central station is assumed to be delivering 1000 kw. uniformly during 24 hours of the day. Then the number of kilowatt-hours delivered during the day will be 24,000. The load curve will be a rectangle, the height of which is 1 in. (if measured in the scale selected above for the purpose), that is, 1000 kw. The base of the rectangle is, of course, a length representing 24 hours. Since the area of the rectangle is given by the product of base and height, or in our case by $24 \times 1000 = 24{,}000$, we see that in this simple case the area under the load curve is equal to the number of kilowatt-hours. The same will be true not only for a 24-hour period, but also for any other period of time. For instance, if we have 100 kw. during ½ hour, the resulting energy is $100 \times \frac{1}{2} = 50$ kw-hr. and at the same time the area under the rectangle, which is the load curve in this case, is also $100 \times \frac{1}{2} = 50$ units.

If we have different loads in successive periods of time of equal length, for instance, the load changing every 15 minutes, Fig. C, the load curve will be a number of rectangles arranged side by side and the total number of kilowatt-hours will be the sum of the kilowatt-hours delivered (or consumed) in the various periods. The area under the load curve will be the sum of the areas of the individual rectangles. Therefore, in this case also the number of kilowatt-hours is given by the area under the load curve. Now, if in a load curve of that kind the rectangles become narrower and narrower, at the same time increasing in number so that the total horizontal length of the diagram remains constant, the same law will always hold good, no matter how short the periods of time are.

Now we can disintegrate the area under *any* load curve into a number of narrow high rectangles and their aggregate area will equal the area under the original curve the more exactly the larger the number of the rectangles and the smaller consequently their width (Fig. D). We can make the error smaller than any desired limit (however small that may be) by making the rectangles numerous enough. Therefore, we can also say quite generally that the area under any shape of load curve is proportional to the number of kilowatt-hours, that is, to the energy. The unit area is a rectangle with the base, 1 hour, and the height, 1 kw.; it corresponds to 1 kw-hr.

B.—LOAD-FACTOR.

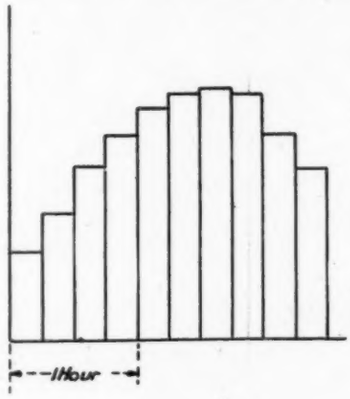
The easiest way to arrive at a conception what the term *"load-factor"* means seems to be to start from the "average load" (or, as it also may be called, the "average power") of a certain period. That is, a load of such size that, if uniformly and without change supplied by the central station (or drawn by the consumer, as the case may be) over a certain period, it results in the same number of kilowatt-hours as are supplied (or consumed) under actual conditions during that period.

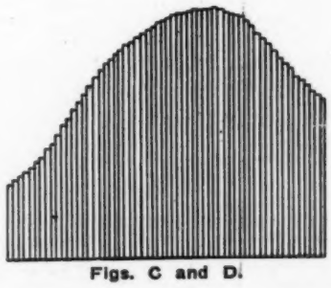
If we transform the area under a given load curve into a rectangle OA_oB_oB (Fig. B), having the same base, OB, as the load curve, the height OA_o of that rectangle is the average load during the period over which the load curve extends. The reason why this is so is easy to see: This load, OA_o, if supplied during the period OB, results in the number of kilowatt-hours given by the area of the rectangle OA_oB_oB, which means it results in the same number of kilowatt-hours as have been actually supplied or consumed, which means it is the average load.

a.—First Definition of Load-Factor.

The ratio $\frac{\text{average load}}{\text{peak load}}$, or, in other words, $\frac{\text{average power}}{\text{maximum power}}$, is called the *load-factor* of the central station (or consumer, or group of consumers) for the given period of time. It is usually given in per cent. The load-factor belonging to the load curve Fig. B would, therefore, be the ratio, $\frac{BB_o}{BE}$ or 37%. This would be the daily load-factor of a certain day, because the load curve extends over one day. In practice, however, the load-factor is much more frequently referred to either the year or the month, so that we have a yearly or a monthly load-factor.

Since the load curve extending over a month, not to say a year, with its numerous large fluctuations, is a very complicated curve and it is impossible to find a convenient





Figs. C and D.

scale for its practical use, the following definition—which in effect is identical with the above— is preferable.

b.—Second Definition.

If we multiply the numerator and the denominator of the above ratio by the number of hours of the whole period (month or year) the value of the ratio is not changed but the ratio takes another form. The average load multiplied by the period over which it extends is, according to the definition of the average load, equal to the number of kilowatt-hours actually supplied (or consumed). The peak load multiplied by the same period is the maximum number of kilowatt-hours which could possibly be supplied (consumed) with the given maximum power in that period, that is, the number of kilowatt-hours which would be the result of the maximum amount of power applying during the whole period. Therefore, the load-factor can be also defined as a percentage expressing the ratio of the energy actually supplied (consumed) to the energy which could be supplied (consumed) in the same time if the maximum load was utilized during the whole time.

The load-factor according to this definition can be easily determined. The actual number of kw-hr. is determined by an ordinary integrating watt-hour meter, and the energy in kw-hr. which could be supplied (consumed), if the maximum load was utilized during the whole time, is

[1]Fig. L. (Insert VII) will show the load curve of a December day and of a June day of the same central station. It shows how the evening lighting peak in June not only is smaller (due to less commercial lighting) but also comes much later than in December.

simply found as the product of the maximum load in kw. by the length of the time over which the load-factor is to be taken, in hours. The maximum load can be found by an instrument known as a demand meter (to be described in Section 140 and Insert XVI).

c.—Third Definition.

Finally, we can also assume that the actually supplied (or consumed) energy has been produced by the maximum load uniformly and steadily applied. It will require a certain period of time until the energy is thus supplied and the ratio of this time to the total time over which the load-factor is taken (one month or one year) is also equal to the load-factor, as can be easily shown graphically (see below). The load-factor is then expressed in terms of "hours per year" or "hours per month," respectively. A load-factor of 10% can therefore be expressed as a load-factor of 876 hours per year (since the year has 8760 hours) or as a load-factor of 73 hours per month (since the average month has 730 hours), depending on whether the load-factor in question is a yearly or a monthly one.

The graphic representation of and proof for this third form of definition of the load-factor is given by transforming the area under the actual load curve into a rectangle of the same area with the maximum load as height. This rectangle OC_0D_0D (Fig. B), therefore, is equal to the energy actually supplied (or consumed); the large rectangle OC_0EB represents the maximum energy which could possibly be supplied (consumed) in the given period with the given maximum power OC_0. The ratio of the rectangles is the load-factor according to the second definition given above of the load-factor. The ratio of these two rectangles is also given by the ratio $\frac{OD}{OB}$, therefore $\frac{OD}{OB}$ is the load-factor.

Where the maximum load is replaced by one of its substitutes (as will be shown in Section 141 *et seq.*, of the main text—"Substitutes to Approximate the Measured Maximum Demand") the load-factor can also be based on one of these substitutes, notably the connected load instead of on the actual maximum load.

(*To be continued.*)

PROPOSED TUNNEL BETWEEN DENMARK AND SWEDEN.

Electric Railway Line to Connect the Two Countries Through the 31.5-Mile Tunnel.

It appears that the Channel Tunnel between France and England has a rival in a tunnel which it is now proposed to construct from Copenhagen, Denmark, in order to make connection with Sweden, states *The Electrician,* of London, England. The main line from Copenhagen, it is suggested, might connect across a harbor dam with the island of Amagar, the tunnel being entered on the eastern coast of the island, while another adjacent island (Saltholm) would serve as a convenient starting place for sinking shafts and tunnelling in two directions. The total length of the line, which will have four intermediate stations, will be 31½ miles, the actual length of tunnel below the surface of the sea being 11 miles.

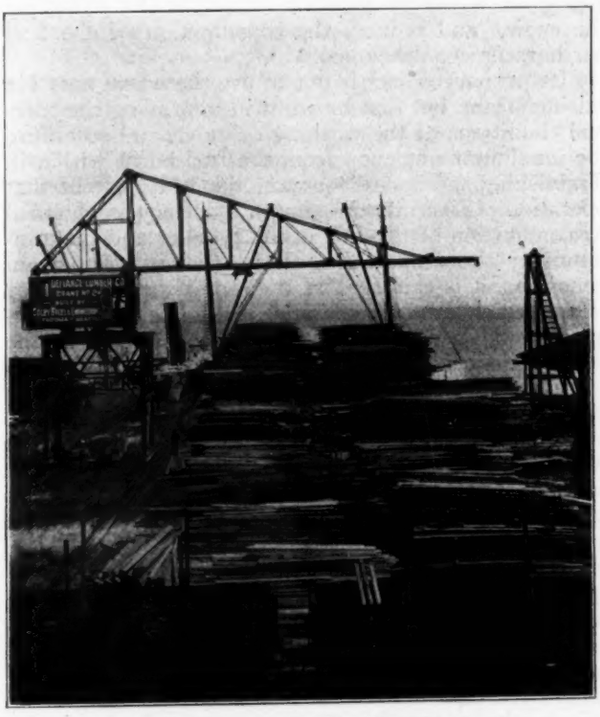
The line is to be supplied electrically from a power station on the isle of Amagar. Initially there will be only a single track, but ultimately two tracks will be available. The bore of the tunnel will be 20 ft. 6 in. The pre-war estimated cost was about $25,000,000.

FLOOD LIGHTS AID IN FIRE-FIGHTING.

At a recent demonstration conducted by the fire department of Dundee, Scotland, it was shown that flood lighting has valuable possibilities as an aid to fire-fighting at night. A floodlight projector mounted upon a tripod frame and equipped with a 1000-watt Mazda C lamp was used. By means of the powerful beam it was possible to identify a fireman working at a height of 400 ft. Although in many cases the light from the fire itself provides sufficient illumination to guide the firemen, very often the members of the department are compelled to work in comparative darkness, which is not only a serious drawback to effectiveness in their work but constitutes a serious life hazard under these conditions. The projector that was used can be operated from a small generator mounted upon the fire engine or it can be supplied from any available central-station circuit. The projector is easily portable.

ELECTRIC REVOLVING BOOM CRANE FOR HANDLING LUMBER.

Facilities for the rapid and economical handling of lumber from sawmills to storage and from the latter to ships or cars, have reached a high stage of efficiency in the use of the revolving gantry crane with horizontal boom, operated by either alternating-current or direct-current motors. A crane of this type lately installed at the mill and shipping dock of the Defiance Lumber Co., Tacoma, Wash., made by the Colby Steel & Engineering Co., Seattle, has 5 tons capacity and is



Electric Crane in Use Handling Lumber.

operated by a 35-hp. motor. The mechanism for the hoist and crane movements is made up of one unit in the cab. By this means the boom revolves in a complete circle, and the operator is able to travel the crane on the track, move the boom in either direction, hoist or lower the load and travel the trolley in or out, all at the same time. Other cranes of this type of 5 tons and 10 tons capacities are in use at shipyards on Puget Sound, where rapid handling of material is required.

ELECTRIC TRUCKS MAKE THEMSELVES KNOWN IN NEW YORK CITY.

Of the total number of trucks in operation in New York City, 10% are said to be propelled electrically. In round figures, there are about 33,000 trucks in operation, those using storage batteries numbering 3288. Before the next year, the number of electrics will be considerably augmented.

The Still Engine — A New Prime Mover

Utilization of Fuel and Cooling Medium Features of the Engine—High Thermal Efficiency and Low Unit of Weight Are Other Valuable Properties — Special Applications

THE Still engine is an engine capable of using in its main working cylinder any form of liquid or gaseous fuel hitherto employed; it makes use of the recoverable heat which passes through the surfaces of the combustion cylinder, as well as into the exhaust gases, for the evaporation of steam, which steam is expanded in the combustion cylinder itself on one side of the main piston, the combustion stroke acting on the other side. It increases the power of the engine and reduces the consumption of the fuel per horsepower developed.

Its primary object is not to use the waste heat for raising steam, but first to use it in improving the thermal conditions of the working cylinder, and so ensure the maximum efficiency from the fuel burnt within it, diminishing, as a consequence, the heat lost in that operation. Since the maximum efficiency is obtained by combustion of the fuel in the cylinder and the minimum by the evaporation of the water in the steam generator, it is evident that the larger the quantity of steam which can be generated per horsepower developed by the combustion cycle, the lower must be the heat efficiency of the whole machine.

Internal-combustion engines are kept cool by the circulation of cold water around their cylinders; the heat thus absorbed causes a rise in temperature of the water as it travels through the jacket, so that the cylinder is subjected to temperature differences and heat stresses, which are an abiding source of trouble and difficulty to the designer.

In the Still engine the jacket and cooling water form part of the circulating system of a steam generator, which may be an integral part of the engine, or external to it. The cooling water therefore enters and leaves the jacket at a constant temperature, regulated by the pressure of the steam, the cooling being effected by converting the water into steam without raising its temperature. Excluding the radiation losses, which are kept low by lagging, all the heat which passes through the walls is thus usefully recovered in the water as steam. The temperature of the cylinder wall is uniform over the whole of its exterior surface, and the heat lost to the cooling water at each stage of the cycle—compression, combustion and expansion—is diminished.

During compression, owing to the walls being at steam temperature, the incoming charge picks up heat, instead of losing it, during the greater part of the stroke, an advantage of the greatest value to the heavy oil types of Still engines, where an air charge is taken in at the full out-stroke, and is compressed to a pressure where its increased temperature ensures the certain ignition and combustion of the fuel which is injected into it.

During combustion and expansion, the uniform and higher mean temperature of the walls reduces the heat lost to the jacket water. Some of the heat thus economized adds to the useful work on the piston, the balance passing out in the exhaust gases for recovery.

Steam from Waste Heat.

After raising their quantum of steam, the exhaust gases are employed in preheating all the water required for the steam generated in the jacket water and in the generator. Trials at full efficiency over long periods and steady loads show terminal stack temperatures as low as 150° F. The heat efficiency of the combined cycles is therefore exceedingly good, with an initial temperature of over 2000° F., and a final exhaust to atmosphere at 150° F.

The quantity of steam capable of being generated from the "waste heat" depends upon the efficiency of the combustion cycle, and on the load. Years of experimental work have proved that the weight of steam recovered may vary from a maximum of about 7 lb. per b. hp-hr. developed by the combustion cycle of a four-stroke constant-volume engine, at full load, to a minimum at light loads which is hardly measurable and which only balances the loss due to radiation.

The steam recovered is a by-product, is limited in amount, its value depending upon the efficiency of its employment. This is carried out in a logical manner. Instead of being expanded in external auxiliary engines, with their thermal and mechanical losses, it is

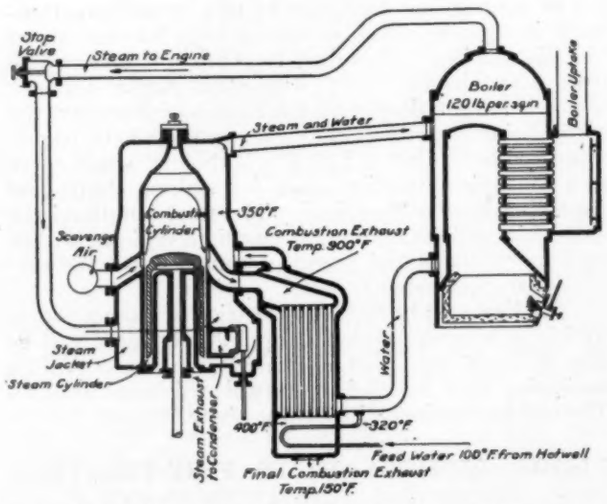


Fig. 1.—Schematic Diagram of the Still Engine.

returned to the combustion cylinders of the Still engine and is expanded on the opposite side of its main piston, one stroke being performed by steam and the other by combustion.

Among the results obtained it may be mentioned that (1) the mechanical efficiency of the whole engine is higher than that obtainable in a normal engine of

similar type; (2) the steam, expanding as it does in a cylinder hotter than itself, gives an indicator diagram larger than that theoretically obtainable under ideal conditions in an ordinary steam engine; (3) 29% of additional brake-horsepower is added to the shaft of the engine, without increase in the fuel consumption (steam not condensed); (4) 40% is added with condenser used (air pump separately driven); (5) the initial horsepower due to steam appears as brake-horsepower added to the shaft, all the mechanical losses having already been accounted for in measuring the combustion brake-horsepower.

The average m.e.p. from the combustion stroke was 90 lb. per sq. in. The steam evaporated by the "waste heat" gave 14 lb. per sq. in. m.e.p. on every return stroke, equivalent to 90 + 28 = 118 lb. per sq. in. m.e.p. in a normal four-stroke engine.

In trials carried on the frictional loss at 65° F. was nearly twice that when the jacket water was at 212° F., the maximum obtainable. In other trials carried on by Still the jacket water was maintained at a constant temperature of 320° F.

By admitting additional steam generated by fuel under the boiler, the steam m.e.p. was raised to 72 lb. per sq. in.; the total m.e.p. was, therefore, equal to 90 + 144 = 234 lb. per sq. in. m.e.p. in a normal four-stroke engine.

The first experimental engine constructed was a two-stroke engine capable of developing 590 b.hp. from three cylinders at 400 revolutions, bore 8 in. It was a high speed engine, designed with special regard to obtaining data about the recovery of steam from waste heat in jacket and exhaust. It was first operated on town gas of 540 B.t.u. and subsequently converted for oil fuel. Its efficiency was not high, owing to its being a two-stroke engine with a short stroke, but its consumption per brake-horsepower was 15 cu. ft. per hour (31.3% efficiency), a very promising result.

The outbreak of war prevented much progress being made in the design and construction of gas engines, but the results achieved give great promise of

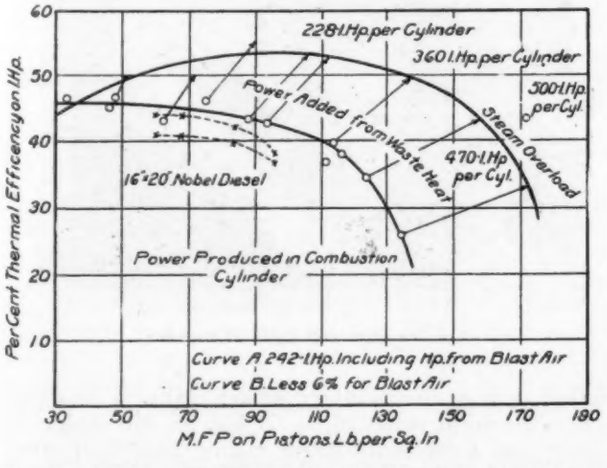


Fig. 2.—Diagram Showing Thermal Efficiency of 13.5 in. by 22 in. Still Engine of the Two-Stroke Opposed Piston Type. Shale Oil Used as Fuel.

future development, for with a combustion indicated efficiency of 36%, radiation 4%, boiler loss 10%, there remains 50% for recovery; allowing 10% efficiency for the steam cycle, a gain of 5% is assured, and the total indicated efficiency of the engine will not be less than 41%. If 20% efficiency is obtained from the steam cycle, as appears possible, the total indicated efficiency will be 46%.

A gas engine which can give a brake thermal efficiency 30% better than its predecessors and which, by governor control alone can meet any demand up to and over 100% overload, while maintaining a good efficiency at that increased output, cannot be neglected.

The Diesel engine relies for ignition solely on the temperature reached by compression of its air charge. On starting, this is carried out in a cold cylinder with a direct loss of heat to the walls during the whole of the compression stroke. A compression pressure of 500 lb. per sq. in. is necessitated to overcome this heat loss. This high pressure increases the cost of construction and upkeep, and, since the maximum explosion pressure capable of being reached in a closed vessel may reach six times the pressure contained in it, the whole design and weight of the engine is detrimentally affected. Its brake thermal efficiency of 30 to 32%, coupled with 20 years of intensive development in all lands, has, however, placed it at the head of all combustion engines in commercial operation using heavy oil fuels.

The Still oil engine starts with the cylinders and pistons preheated. The air charge, from the moment it enters into the cylinders, picks up heat from the containing walls and continues to do so during at least 70% of the compression stroke. The result is that the temperature necessary for firing with certainty the first injected charge of fuel is reached with a compression pressure 50% less than that required in a Diesel engine. This fact is far reaching in its importance, for it gives to the designer great elasticity and freedom of application, for a Still heavy oil engine can be designed for constant pressure or constant volume, or both can be employed in the same engine by correct timing of the fuel injection. It claims for its combustion cycle an efficiency higher than that of the Diesel, less weight and space per horsepower, and for its combined cycle an efficiency not less than 20% higher than any prime mover which uses fuel as its source of heat.

A unit of this type has been subjected to many long and varied tests by representatives of various governments, as well as to constant research work under severe conditions. Its best consumption of fuel (Admiralty shale oil) has been as low as 0.302 lb. per b.hp. (scavenge pump not included), over a test of one hour's duration under normal waste heat conditions. It developed 330 b.hp. for six hours at 360 r.p.m. (a single cylinder) under waste heat conditions. The thermal brake efficiency from below quarter load to full power is maintained at approximately 40% over the whole range.

Engines of this type operating at 120 r.p.m. with a cylinder 22 in. diameter by 36-in. stroke, giving 4200 s.hp. on two shafts, with all auxiliaries and water, would approximate 600 tons. A geared turbine plant in a similar ship would weigh 20% more and would consume approximately 2000 tons more fuel for a double journey lasting 1000 hours.

HARNESSING OF WATER POWER IN MEXICO TO GO AHEAD.

The Mexican government is planning to make a complete survey of all available water-power sites and to estimate the amount of energy which may be generated. Original concessions granted Americans and other foreigners were cancelled by the Carranza government.

Comparison of Mechanical Stokers

Classification of Mechanical Stokers—Salient Features of the Different Stokers — Influence of the Stoker Upon Draft, Combustion Chamber, Etc. — Part II.

By ROBERT JUNE

Mechanical Engineer.

AS HAS already been shown in the preceding articles, the advantages of the mechanical stoker over hand-firing are as follows:

1. Even and continuous firing of the automatic stoker, as compared to the intermittent action of hand-firing.

2. Practically constant and uniform supply of air which can be controlled to some extent to meet actual operating conditions, as contrasted with the wide variations in air supply occurring in hand-firing, with constant opening of fire doors, and varying depth of fuel bed.

3. Continuous and automatic cleaning of fires, leading to better over-all efficiency.

4. Large savings in labor, due to fact that one man can take care of 2000 hp. of stoker-fired boilers, as compared to 250 to 500 hp. of hand-fired.

5. Saving in fuel cost through ability to burn lower grades of coal than can be handled to good advantage with hand-firing.

6. Practical insurance of smokeless operation.

Overfeed Stokers.

Overfeed stokers are of two types—front-feed and side-feed. To the first type belong the Roney, Wilkinson and Acme stokers; to the second type, the Detroit, Murphy and Model.

With the front-feed stoker, the grate, which is arranged in a series of steps, slopes at a considerable downward angle from front to rear. Coal received from the hopper is coked under a short suspended arch and is then fed forward and downward by the rocking action of the movable grates, aided by gravity. The clinker working forward, is emitted at the bottom, being crushed by rolls in some types of installations. For convenience in handling, the dumping grate is frequently divided into several sections.

Front-feed stokers possess the important advantage of permitting easy passage of air through the fire so that complete and efficient combustion is readily secured. On the other hand, their combustion is such that if boilers must be continuously driven at high ratings, the grates may become overheated. In order to avoid this danger of burning, with possible necessary renewal of grates, engineers usually prefer other types of stokers, if it appears probable that boilers must be operated above 200% rating for considerable periods of time. Front-feed stokers used either natural or forced draft.

The side-feed or "V" stoker receives coal from two magazines, located on each side of what, to all intents and purposes, is a Dutch oven. At the bottom of the magazines are coking plates against which the grates, which are inclined at a steep angle toward the center of the furnace, rest at their upper ends. As the coal leaves the magazine, from which it is fed alternately and intermittently, it rests for a short time upon the coking plates. At this point the volatile gases are largely driven off, being mixed with air which has been pre-heated by admission through the arch over the fire.

As combustion proceeds, the fuel travels slowly down the inclined grate toward the clinker grinder, receiving the requisite amount of air through the grates to complete the process of combustion by the time the lower portion of the grates, where the ash and clinker are automatically removed.

The speed at which the stoker boxes push the coal into the grates is of course subject to easy regulation. The grates, being protected at their upper ends and actuated at their lower ends, agitate the fuel bed to a constantly increasing extent as combustion proceeds, thus permitting free admission of air and assuring complete combustion. In stokers of this type the clinker grinder can be adjusted to operate with reference to the amount of ash and clinker in the coal, irrespective of the action of other parts of the mechanism.

For boilers of moderate size, operated at 200% rating or less, the side-feed stoker makes a desirable and economical installation. It has the advantage of possessing a decidedly larger coking area than other types of stokers, and as its combustion area is likewise very large, it is possible, with careful manipulation, to secure complete and practically smokeless operation. Natural draft is the rule with this stoker.

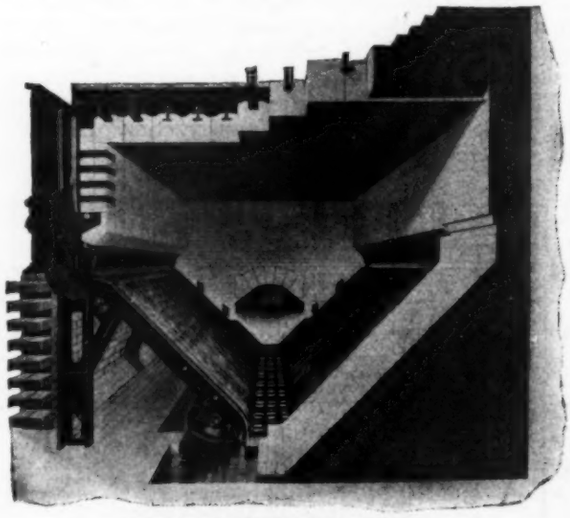


Fig. 1.—Overfeed Type of Stoker.

The Down-Draft Furnace.

While the down-draft furnace is not to be strictly classed as a stoker, since its use involves hand-firing, it nevertheless deserves consideration, since it per-

forms certain of the functions of the mechanical stoker; that is to say, as compared to ordinary hand-firing, it permits the use of lower grades of fuel, assures practically complete combustion, and what is extremely important in many installations, smokeless combustion.

The down-draft furnace consists of two separate grates, one above the other, the upper grate being formed of a series of tubes, opening at their ends into steel drums or manifolds, through which the water of

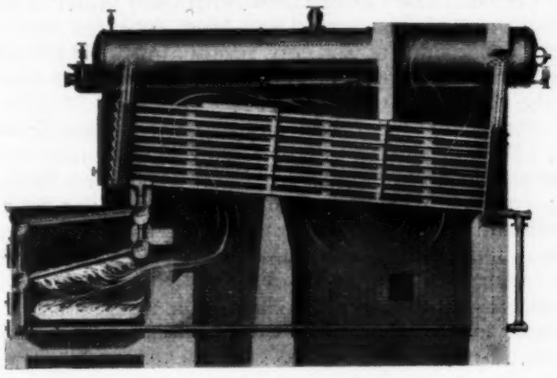


Fig. 2.—Down-draft Type of Stoker.

the boiler circulates, whereas the lower grate is formed of ordinary grate bars. The firing doors are near the top of the furnace and the upper grate only is fired. This grate, it should be noted, slopes upward at a sufficient angle to assure rapid circulation.

A division wall at the back of the furnace prevents the gases from going rearward, hence the draft is downward through the fuel bed, and the volatile matter, as it is evolved, passes directly between the grates into the combustion chamber. The lower grate is fired entirely by coked coal falling through the tubes of the upper grates. As the flames from the lower grate arise, they meet the down-coming gases and the process of combustion is completed.

An objection sometimes raised to the down-draft furnace is that it "cannot be forced above rating," but this is not strictly true as it can be driven to nearly if not fully the same extent as a hand-fired furnace. When installed under conditions within its limitations, it is more economical and satisfactory than hand-firing.

The Under-Feed Stoker.

Among the best-known underfeed stokers are the Taylor, Westinghouse, Type "E," Riley, Jones and American.

The under-feed stoker is the stoker for large installations and exceedingly high ratings. Indeed, so completely has it pre-empted this field that it is unusual to go into a large central station or high-duty large boiler power plant of any sort, built within recent years, and find other types of stokers installed.

There are a number of reasons for this. First of all, the under-feed stoker is adapted to all grades and sizes of free-burning bituminous coal. Next, it is essentially a forced-draft stoker since it operates with restricted air openings, and very deep fires. The forcing capacity is almost unlimited, instances being known where this stoker has been driven to over 400% rating.

Sufficient combustion-chamber space is the principal consideration in making under-feed stoker installations, as with this stoker it is necessary to elevate the boiler a very considerable distance above the floor. Coking arches or plates are dispensed with entirely. The principle of the under-feed stoker is that of a steam-driven ram, which forces the fresh coal into a large receiving retort, contained within the furnace, and from there up under the fuel bed.

The Jones stoker consists of nothing whatever except this retort, or a series of retorts, depending upon the size of the boiler. There are no grate bars and no ashpit, just a blazing pile of coal, continually fed with new supplies pushed up from below. Air is admitted through hollow blast tiles at the upper edges of the retort. Ash and clinker form chiefly on the dead plate between the retorts and are removed by hand at intervals of a few hours. Automatic control of air and fuel supply is secured, definite proportions of each being admitted as the steam pressure tends to rise or fall.

In the Type "E" stoker the retort has a reciprocating sliding bottom which carries the coal forward. It is delivered uniformly from front to rear by auxiliary pushers, and as it rises in the retort, is distributed to the sides of the furnace by means of rocker bars, so set as to slope both ways from the center of the furnace toward the side walls. The progress of the burning fuel and also of the ash and clinker is thus from the center to the sides of the furnace. As the action of the rocker bars is slightly up and down, clinker is kept from forming in large pieces. Dump trays at the side permit cleaning by the act of throwing a single lever.

More elaborate than other underfeed stokers, the Taylor consists of a series of alternate retorts and tuyeres, sharply inclined toward the rear of the furnace. Each retort is fitted with two rams—the upper for pushing the green fuel inward and upward, the lower for forcing the fire toward the dump plates at

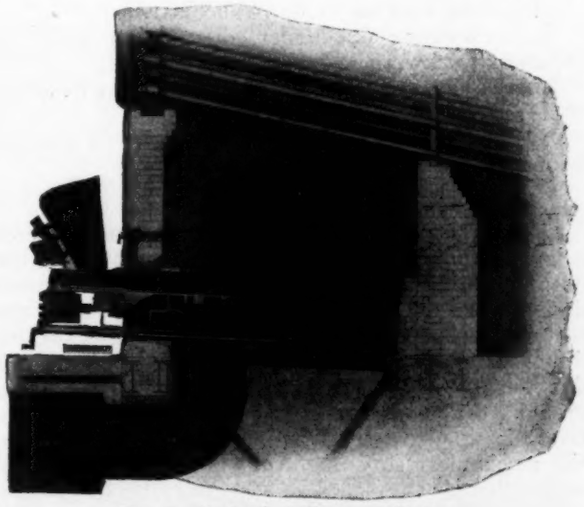


Fig. 3.—Underfeed Type of Stoker.

the rear. The dump plates referred to are hung on the rear of the wind-box. They are controlled from the front of the furnace. This stoker may be operated efficiently and smokelessly at the heaviest known overloads, hence it is frequently found in the largest plants. Stoker and blower are operated by the same engine and power required for this purpose is from 2.5 to 5% of steam generated, making it probably the highest steam user among the stokers.

The Riley is a multiple-retort stoker, the distinctive feature of which is that the sides of the retort

reciprocate relative to the bottom. This arrangement results in the fuel being moved at a uniform rate out of the retort and across the ash supporting plates

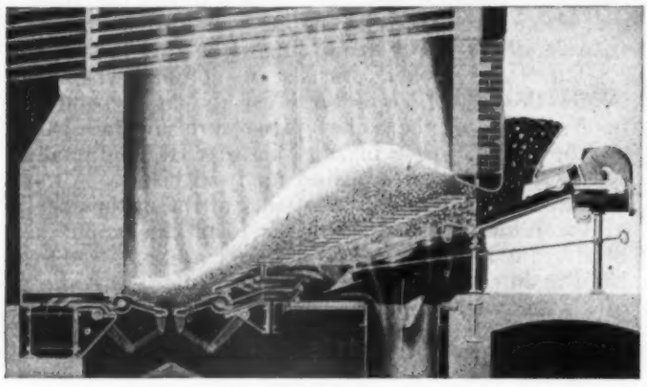


Fig. 4.—Cross-Section Showing Fuel Bed With Underfeed Stoker.

until it is discharged through adjustable openings next to the bridge wall.

POINTS TO REMEMBER REGARDING STOKER OPERATION.

The following are a few of the points to remember regarding stoker operation.

1. Draft must be under close control at all times.
2. Keep air vents open.
3. Look out for air leaks, particularly after making adjustment.
4. Make frequent flue-gas analyses.
5. Keep side walls clean of adhesions.
6. Do not stop stoker long with hopper full of coal.
7. In chain grates make adjustment of gate and speed if fire tends to withdraw from gate or run over end
8. Coking coal may require slice bar.
9. In washing out boiler, do not get water on arches or brickwork.
10. Do not pull dead plates entirely clear of ash.
11. Keep ash-pit cleared out.
12. Have all necessary maintenance work attended to promptly.

SUMMARY.

It has been shown that the chain-grate stoker is suitable for boilers of good size up to 250% and that its important characteristic is that the grates must be designed for the fuel burned. It has been shown that the overfeed stoker is particularly suitable for medium sized installations up to 200% rating. The down-draft furnace, particularly for small boilers operated at non-excessive ratings, offers a comparatively inexpensive substitute for certain functions of the mechanical stokers. And, finally, the underfeed stoker has been placed as the apparatus for large boilers, operated at extremely high ratings.

TRANSFER OF GUATEMALAN ELECTRIC PLANT TO AMERICAN COMPANY.

German Plant Taken by Government and Leased to American Interests—Extensions Proposed.

The electric lighting and power plant of Guatemala City (Empresa Electrica de Guatemala) was granted a 30-year concession some 25 years ago for electric lighting and power service in the city of Guatemala. The enterprise has always been a German institution, and more than 90% of the stock was held by the Deutsche Bank of Berlin. By executive decree No. 742 of October 16, 1918, this property was taken over by the Guatemala Alien Property Custodian and by later decree was declared forfeited to the Guatemala Government and nationalized. By executive order this property has now been leased to Henry W. Catlin, No. 71 Broadway, New York, for the term of 10 years, at a cash rental of $40,000 per annum, together with the option of extending the lease for an additional like period. The Government concession under which the old company operated has been extended for the life of the contract and any prorogation. The lessee also becomes the preferred bidder in any future sale of the property.

The plant was erected by the Siemens-Halske Co. (Berlin), and is hydroelectric, with a present capacity of 2000 kw. at 4000 volts three phase alternating current, which is transmitted from the power station at Palin, 28 miles distant from Guatemala City. This is reduced at the local station to 1000 volts for primary distribution over the city. The house service is 120 volts. The entire pole line, both transmission line and for city distribution, is made of 9 and 10-in. I-beams. Some 16,000 incandescent lamps, 280 open arc street lamps, and 2000 hp. in motors are served.

Before the earthquakes of 1917-18 about 30,000 incandescent lamps were connected.

The leasing company also acquires the right to an incompleted additional water power and central station at San Luis, about 6 miles from Palin, the present operating station which, when completed, will give an additional 3000 kw. This additional power will probably be completed promptly by the leasing company, as there is much demand for additional light and power service in that city. It is a common thing to see advertisements of electric motors for sale, "with right of electric service," and at the offices of the company are many applications for power awaiting their turn. The plant as it stands today has an estimated valuation of $1,000,000, and the cost of completing the auxiliary station is estimated to be in the neighborhood of $300,000.

IMPROVEMENTS IN POWER PLANT AT ST. JOSEPH, MO.

New Condensing Turbo Unit—Oil-Burning Equipment—Other Rehabilitation of the Plant.

Improvements in the plant of the St. Joseph Street Railway, Light, Heat & Power Co., St. Joseph, Mo., which will amount to approximately $1,000,000, have been started. Excavations are now completed. The improvements are to include a 12,500-kv-a. turbine-generator complete with surface condensers and auxiliary switchboard equipment. This new unit alone is able to take care of all of the city's present requirements and 20% additional, which includes both light and power and leaves the entire old installation to take care of further increases in the future. Workmen are relocating two 440-hp. boilers and are installing two additional boilers of 1000 hp. each. A complete new arrangement of boiler-feed pumps and accessories will be made. A complete oil-burning system will be installed throughout the plant, which will do away with coal entirely. This includes a 30,000-barrel fuel-oil storage tank, with 800 ft. of track for the supply of oil. Two new steel stacks will be constructed, one 16 by 225 ft. and the other 12 by 225 ft.

NEW PLANT FOR MANUFACTURING RADIO APPARATUS.

Brief Description of the New Kilbourne & Clark Factory at Seattle, Wash.—Motor Drive Throughout.

By W. A. Scott.

A brief outline of the new factory of the Kilbourne & Clark Manufacturing Co., of Seattle, Wash., will be of interest because in it there are exemplified the most advanced facilities for constructing and testing radio apparatus, and because of the world-wide demand for the company's products. Wireless equipment of the Kilbourne & Clark design, which was developed a few years ago, won its way to favor almost at the beginning, with none to challenge its efficiency. During the war its production was increased with great rapidity to keep pace with the tremendous demand for radio apparatus for new ships of war and commerce, and to supply the facilities for operating wireless stations on land, both in the United States and in allied and neutral countries.

This strictly American industry, to which great impetus was given because its product was a war essential, found at the close of the war that a national and international demand had developed for its apparatus.

The new plant at Seattle, designed and equipped to meet the requirements of this specialized industry, was completed and put in operation within the last three months. The building made up of four interconnected structures, is well shown in one of the illustrations presented herewith. It is constructed of reinforced-concrete walls, and wooden floors laid upon concrete slabs, with roofs of saw-tooth type to afford the best possible daylight and ventilation; the roofs are of mill construction, a part of the framework being supported by timber columns.

The main shop building, an interior view of which is given, is 100 ft. wide and 300 ft. long, having a 24-ft. ceiling. The lengthwise direction of this shop structure is north-south.

The three wings built at right angles to it extend easterly toward Whatcom avenue on which the plant fronts. The center wing, as is shown in the illustration, constitutes the office building, which is 60 by 60 ft. The south wing, 60 by 100 ft., is the laboratory and engineering building; and the north wing, 60 by 100 ft., is the stock and storage building. By referring to the exterior illustration it will be noted that there are parkings in front of and on both sides of the office building, and that the north and south wings come out flush to the sidewalk adjoining the paved street.

Electricity for Motive Power and Testing.

Electricity is utilized for all power requirements and testing operations. Energy is supplied from two outdoor 100-kv-a. transformers at the rear of the main shop building, being transmitted at 220 volts through lead-sheathed overhead cables to the main switching panels in the shop. The power load is not a heavy one, as most of the driven machines and tools are for comparatively light work in which precision and speed are the essential requirements.

The 43 Wagner motors installed are practically all alternating current, operating at 220 volts at different speeds, although there are no variable-speed motors.

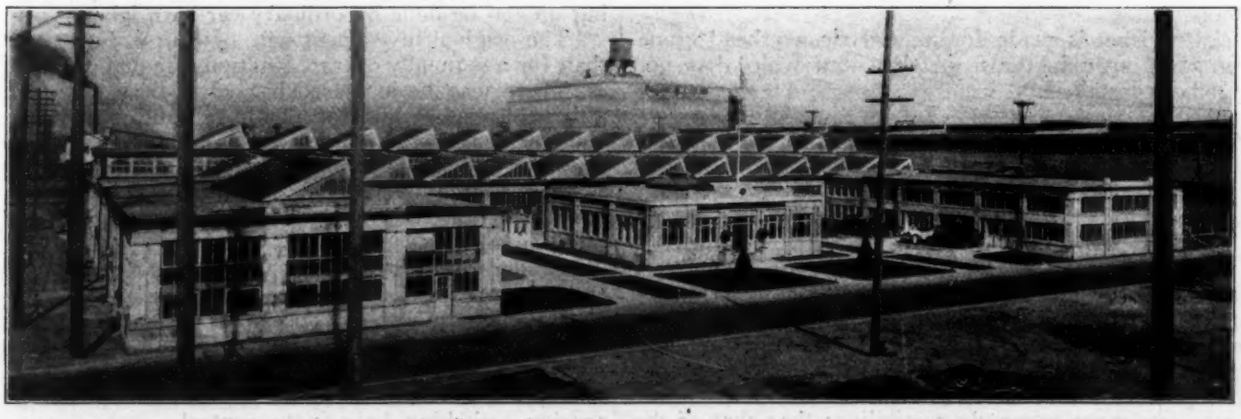
It will be observed, by reference to the interior view of the main shop, that the most of the lathes, drills and milling machines are operated in groups by motors hung from the ceiling. These motors are of 5-hp. and 10-hp. capacities, leather belts being used for transmitting power from the motors to line shafts and for connecting the latter to the tools and machines. There are, however, a number of lathes and other tools of the heavier class which are driven by 10-hp. and 15-hp. individual motors, each set upon the floor and connected to the driven machine by a short leather belt. Some of the heavier tools thus operated consist of a Cleveland automatic lathe, and three Revette lathes.

An interesting feature of the shop work is seen in the tool-making department, where motors of light capacity and high speed, with leather-belt transmission, are required in driving special machines in groups. Here precision tools and devices are made which are adapted to the work in manufacturing wireless apparatus.

In the speedy production of parts required in assembling radio equipment there is maintained a systematic routing of work through the factory, and the mechanical and electrical installations were arranged with that system in view. The thorough inspection methods established are applied to all stages of the manufacturing.

The raw materials used in wireless apparatus consist of steel, brass, copper, aluminum, and insulating material, the last named consisting chiefly of Bakelite-Dilecto, a trade name for a special kind of condensation product of excellent insulating and mechanical properties.

The laboratory is equipped with the latest types of



General View of the New Plant of the Kilbourne & Clark Manufacturing Co. at Seattle, Wash. In Plan View the Buildings Form a Large Letter E.

View of Part of the Laboratory and Testing Department for Development and Testing of Radio Apparatus.

Interior View of the Main Shop Building of Kilbourne & Clark Plant.

instruments and appliances for testing out radio apparatus before shipments or deliveries are made. Many standard and special instruments are also required in research work. As direct-current energy is required in testing part of the apparatus, a 25-kw. motor-generator set was installed in a compartment adjoining the laboratory and testing room, to convert alternating to direct current. This consists of a Wagner motor and a Westinghouse generator. In one of the illustrations is given a view of the laboratory and testing department.

An engineering organization is maintained, not only to make inspections and tests, but to conduct research work and to produce new and improved designs along the lines of the radiotelegraphic development. In this connection there is operated an electrical blue-printing and drying department for the rapid production of shop drawings.

Illuminating Facilities.

The buildings are wired throughout in conduit, providing outlets for high-intensity, glare-free general lighting. The main shop building is illuminated by 110 of the 200 and 400-watt Mazda C lamps, spaced 12 ft. apart, and equipped with Ivanhoe Reflecto-Cap units. The laboratory is served by 100-watt lamps and reflectors of similar type, while the offices are illuminated by 150-watt Mazda C lamps in Perfeclite semi-direct fixtures. Other parts of the plant are lighted by 100-watt units with steel dome reflectors. but without diffuser caps. Except in a few special cases no local lamps are required for machines and tools.

Provision is made for an electric overhead crane of 31-ft. span in the main shop, but which has not yet been installed.

THE AUTOMATIC SUBSTATION FROM AN ECONOMIC STANDPOINT.

How Electric Railways with Light Traffic Can Save Money by Installing Attendantless Substations.

The tendency in the development of modern electrical apparatus is to utilize more and more the automatic features which are proving to be important factors in extending its use. Probably no recent development has created more general interest or possesses more economic possibilities than that of the automatic substation for electric railways, especially interurban.

The automatic substation usually consists of a synchronous converter, a bank of transformers and three or four switchboard panels, on which are mounted electrically operated switches, relays and instruments. It is really almost uncanny in what it will do when the trolley voltage falls below a predetermined safe value. Without human aid the converter starts up and reaches synchronism and assumes its share of the total load on the line. If the load increases to a point dangerous to the converter, it immediately shuts itself down and the line switches all open. If a converter bearing should overheat, instantly a relay operates and the converter shuts itself down. If the load on the line drops to a point where the converter is not required, it automatically comes to rest. It will go through this cycle of starting and stopping just as often as the line conditions make it necessary, it being possible to start up, close all switches, open all switches and stop the converter twice per minute.

Naturally, since such power is at instant call without an attendant at the station certain limitations exist which react to counterbalance the good qualities of automatic switching but they in no way destroy the great commercial advantages of such switching.

A competent engineer must inspect the apparatus weekly and the station must be cleaned up three or four times a month. One engineer could inspect a great many stations on a regular schedule, so this item will add but a trifling labor charge. The cleaning up can be done by ordinary car-barn labor.

The original investment will, of course, be greater than for a manually operated station of equal capacity.

There may be increased hazard to the equipment, although results thus far obtained indicate that the equipment is better protected by automatic switching than by hand switching.

Automatic switching is more complicated than hand switching, but on close acquaintance it becomes quite simple.

Feeders must be applied with great care to save trolley wires which drop to the ground from annealing.

Since there are no operators to transfer high-tension lines in case of trouble these lines may in certain cases have to be arranged for automatic installations. It may be possible to handle this high-tension switching by remote control.

The economic features which offset the foregoing disadvantages are so great that they leave a heavy balance in favor of the automatic switching. The fact that automatic substations require no attendants should itself effect an economy of $2500 per station, allowing two men per station for hand switching. The absence of attendants leads directly to a second marked advantage, the elimination of labor difficulties. This is an important factor under the present disturbed condition of labor generally and the uncertainties of the future.

Since the automatic station shuts itself down when power is not required, the saving in energy will amount to a considerable item. No-load losses are thus eliminated, which is particularly advantageous on interurban lines where the power requirements are intermittent.

There is also a reduction in feeder loss as the substation can be located exactly where needed without reference to labor operating cost. By relocating or increasing the number of substations enough feeder copper can be saved on many propositions to pay for a great proportion of the cost of automatic switching.

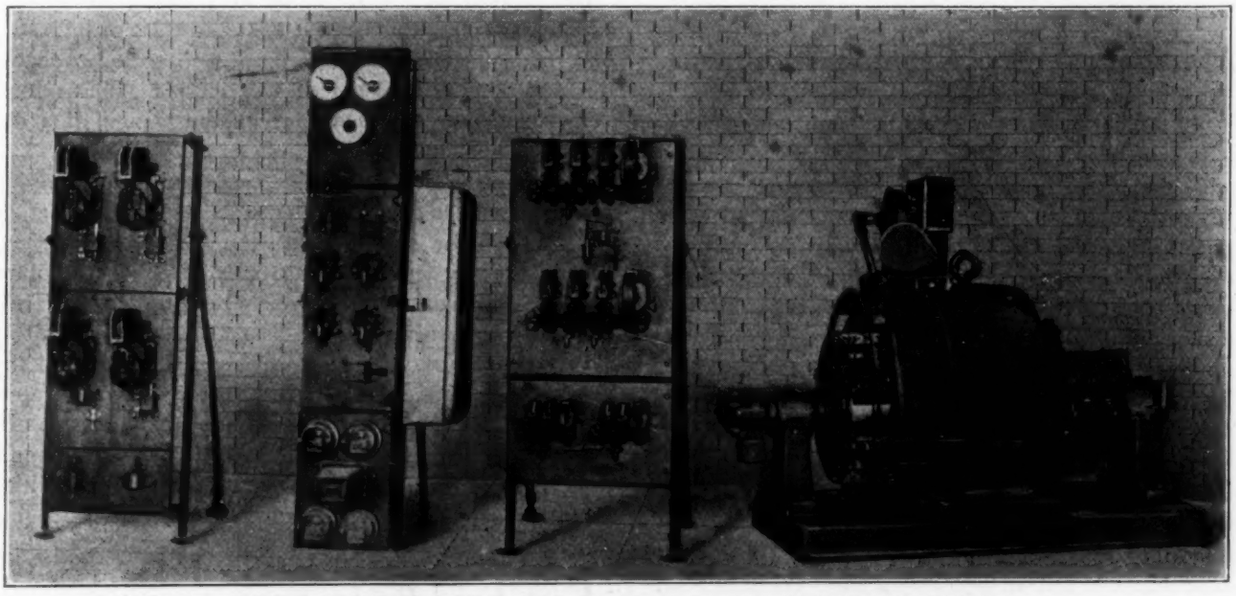
TYPICAL ECONOMIES OF AUTOMATIC SUBSTATIONS.

Headway between cars, Hours	1	2
Length of line, Miles	25	25
Number of substations	3	3
Capacity of substations, Kw.	300	300
Distance between substations, Miles	10	10
Schedule speed, M.p.h.	25	25
Length of operating day, Hours	20	20
Total substation hours (manual operation), Hours	60	60
Total substation hours (automatic operation), Hours	32	20
Running-light loss per station, Kw.	15	15
Energy saved per day (automatic operation), Kw-hr.	240	600
Energy saved per year (automatic operation), Kw-hr.	153,300	219,000
Value of energy saving at 1 cent per kw.-hr.	$1,533	$2,190
Labor saving per year (6 operators at $70 per month)	$5,040	$5,040
Total saving per year	$6,673	$7,230
Total investment automatic control—3 stations	$1,800	$1,800
Interest, insurance, maintenance, depreciation, taxes—15%	$2,700	$2,700
Cost of inspection per year	$ 500	$ 500
Total annual charges	$3,200	$3,200
Net annual saving	$3,373	$4,030
Return on investment, per cent	18.7	22.4

CUSTOMER OWNERS HELP SAVE PLANT.

Recently the Minnesota Valley hydro plant of the Northern States Power Co. experienced the highest stage of water on record. Nearly five feet of water was spilling over the dam and the tail water rose to 19 feet, flowing into the plant through the windows and doors. C. D. Hunt, manager of the Southwest Division of the company, reports the following as to what transpired:

"The farmers living in the vicinity of the plant came to our rescue at midnight and faithfully manned the pumps for 48 hours until other means could be employed to lower the water in the generating room of the old part of the plant. It is significant that nine of the farmers who came to our rescue were stockholders in the company. These farmers left their work for 48 hours to assist in the work of saving the plant."



Typical Automatic Substation for an Interurban or Other Light Electric Railway.

There is invariably a reduction of electrolysis due to absolutely correct location of automatic stations, thus reducing the return circuit in length and in losses due to drop.

Experience thus far indicates that reliability of operation will be increased. Considering the ability of the best operators that can be secured and the introduction of the ever varying "human element," the automatic switching should prove by far the more reliable method of operation.

Maintenance has been very low in those cases which have been under operation. This charge will drop exactly in the proportion that inspection and cleaning of apparatus is kept up and with experience will doubtless drop to a very low value.

Summing up, there is do doubt but what the automatic substation is here to stay and its economic features demand consideration whenever the installation of a new substation is projected. The following table shows typical economies from such an automatic substation:

COAL SAVING DUE TO DAYLIGHT SAVING.

During the daylight saving season last year, the Edison Electric Illuminating Co. of Boston saved 4420 long tons of coal because of the extra hour of daylight utilized by turning the clock one hour forward. The decrease in kilowatt-hours from this cause was 5,000,000, representing a loss of revenue of about $350,000.

Editorial Comment

Daylight Saving to Stay

PRESIDENT WILSON'S veto of the Congressional attempt to repeal daylight saving and the failure of the House to pass the measure over his veto settles the fate of this summer-time practice probably for another year. The only avowed opponents of the practice are the farmers who must engage help to work their fields. Apparently they are an influential lot, for they quite readily awed Congress to meet their wishes. We are convinced, however, that the great majority of the country's citizenship is heartily in favor of daylight saving every summer. Electric lighting companies are sufferers from it, but almost without exception they are glad to bow to what is manifestly for the public good.

Machinery Must Replace Emigrants

NOW that peace is here, swarms of aliens are leaving this hospitable land and going back to their native abodes with their pockets swollen with American money earned during their profitable sojourn among us. The great majority of these emigrants have not assimilated our ideas or customs or even our language. Their departure is therefore in one respect no serious loss to our country. But it is a substantial loss to our labor supply. To what extent immigration will replace emigration is very uncertain. There is one certainty, however. It is that machinery will have to be called on more and more to do work that is now done manually, so that the remaining labor will be more effectively applied. Increased use of machinery means more electric motors for driving it and more electric power for keeping the motors running. The electrical industry is ready to do its part in this case just as it has done in relieving the emergency in household work since servants became scarce.

Higher License Fees for Contractors

CHICAGO'S proposed new ordinance governing the licensing of electrical contractors which is reviewed elsewhere in this issue may at first appear to be a rather stiff and expensive proposition calling for a needless outlay which must be borne by the electrical contractor. However, when the conditions existing are understood it surely seems justified. There are at present many journeymen carrying licenses while working for legitimate contractors who compete with their employers for work. In addition, there are many others, such as the maintenance men in large plants who carry on a lively contracting business in the evening and during their other spare hours.

In view of these facts, therefore, it is not surprising that the contractors themselves favor the ordinance and wish to see it become a law. The classifying of licenses is another good feature of the proposed ordinance, for there is no reason why a manufacturer who only has repairs and alterations made in his own equipment should pay the same license fee as the general contractor who does all kinds of electrical work.

A Highly Efficient Engine

ON other pages of this issue are given some of the principal features of the recently developed Still engine, which has aroused a great deal of attention in Great Britain. This unique prime mover deserves as much attention in other countries. Its most important feature is the very high thermal efficiency attained, this being 40% or over. An indicated thermal efficiency of as high as 46% seems probable in future developments of this engine. These high efficiencies are obtained through the combination design of this unit.

Primarily it is an internal-combustion engine whose cylinder-cooling water is kept practically at or just above the boiling point, the steam thus formed being used either in another cylinder or on the other side of the main cylinder to help develop power. Thus the water carries away the heat and utilizes it effectively instead of wasting it as usual. The heat in the exhaust gases is used to preheat the circulating water, so that the gases are discharged at as low as 150° F. Although the engine does not seem to be a very simple one in construction it has very promising possibilities and we expect to see it outdistance the Diesel engine at least.

Keep Food Prices From Soaring

FURTHER increases in the prices of many foodstuffs are offered as the excuse for demands for further wage increases, for increased prices for a variety of commodities and for a reluctance to buy necessities. The net result is a check to the steady expansion of business. Advanced prices in one line react on other lines and there is produced a seemingly endless cycle of continued advances. This is not wholesome to business or industry nor to the country as a whole. A check must be put to it.

Since food prices receive the principal blame, let this be the line to be prevented from further inflation. In view of the fact that food supplies and food distribution will remain abnormal for about a year on account of the inability of Europe to get squarely back on its feet before that time, all attempts at profiteering in foods, cornering of food supplies and unscrupulous speculation in this line should be dealt with as vigorously as they are being treated in France

and Italy. Public utility service is firmly under public control. Is food less essential, so that it should not be controlled? Stop the food profiteer, so as to stabilize wages and prices of commodities and thus permit commerce, industry and labor to supply the wants of the world.

Electric Lighting Needed Still More in Summer Resorts

VACATION time is here with its hegira of city folks to the country, seashore and mountains. The hot and sweltering city is gladly left behind for the pleasure of the big outdoors and the relaxation of simple, rural life. And after a few days of this simple life some of its shortcomings force themselves on the average city person who dislikes to do without the more essential conveniences of modern urban life. If the resort at which he is stopping is one of those that were almost universal up to a few years ago, he misses electric lighting probably more than any other utility to which he is accustomed.

The reason for this is obvious. Electric light is the most safe and convenient kind of illumination. Oil lamps, acetylene or gasoline lights are far from being its equivalent. They are very hazardous under any conditions and especially so in the wooden buildings still so very common in summer resorts, even among the more expensive ones. Electric lighting permits dispensing entirely with matches, a fruitful source of disastrous fires. The competing types of lighting mentioned above are also by no means as convenient, comfortable or healthful, especially on a very hot or sultry evening.

In the last few years considerable headway has been made in providing electric lighting in summer hotels and cottages. Where resorts are quite close together they are now frequently served from the lines of some neighboring central station. In other cases where a number of hotels or private houses are clustered into a small community that is itself remote from any regularly established central station or transmission line, it has become the practice to install a self-contained lighting plant of such size as to serve the community. In still more cases of isolated resorts it has become quite common to put in a lighting plant of the farm-lighting type with storage battery to carry the load of the late night hours.

These installations of electric lighting in summer resorts, whether they be any of the types referred to or modifications thereof, are proving to be very popular, especially if their capacity is large enough to also permit the use of small portable appliances, such as hair curlers, fans for very hot nights, travelers' flatirons for pressing ladies' dress accessories, etc. There is much room for installation of more of these electric lighting systems in the resorts that are still trying to get along with other methods of lighting that are not only obsolete but seriously endanger the lives of their guests.

Real Co-operation in the Electrical Industry at Last

CO-OPERATION, such as has been long desired and talked about as a necessary adjunct to the electrical industry, was demonstrated for the first time in a national way at a conference called by the Executive Committee of the National Association of Electrical Contractors and Dealers in Milwaukee on Monday of this week. On this occasion the various branches of the industry were called together to discuss and develop the Bureau of Education and Research which has been organized by this association. In addition to the representatives of this association there were present the authorized representatives of the Associated Manufacturers of Electrical Supplies, the Electrical Supply Jobbers' Association and the National Electric Light Association and the electrical press.

The picture presented by these men gathered together to discuss a national proposition of vital importance is surely evidence that the co-operation idea has at last taken root in our industry. Nor did they gather merely to discuss co-operation, as is generally the case, but for the purpose of developing and starting a co-operative effort for putting real co-operation into effect.

The Bureau of Education and Research is an elaborate and extensive plan for promoting the sale and use of electric apparatus. The idea of the plan, as explained in an earlier issue of the ELECTRICAL REVIEW, consists of an educational campaign to be carried on among the contractor-dealers of the country by which it is expected to materially increase the sale of electrical appliances and improve the conditions among the trade. However, in order to accomplish its purpose a fund had to be established which the contractor-dealers' association was not able to finance from among its own members. Its officers, therefore, called upon the other branches of the industry for assistance which resulted in the conference.

After considerable discussion a fair and equitable plan was devised by which all branches of the industry contribute to the support of the movement. The expense of the national work is to be borne by the manufacturers of electrical appliances in proportion to the amount of sales obtained through the efforts of the members of the National Association of Electrical Contractors and Dealers. The expense of the local propaganda is to be borne by the local jobbers, the central stations and the larger contractor-dealers in like proportion.

Aside from the importance of this plan, however, the principal feature is that for the first time in its history all the branches of the electrical industry got together on a national proposition, thrashed it out on an equitable basis and really did co-operate. For this reason, especially, it is hoped that the plan will prove a tremendous success and encourage future activities along similar lines.

Current Events

Big Electrical Conventions at Milwaukee and Cedar Point —Electric Railway Investigation Bringing Out Real Facts

WORK ACCOMPLISHED FEATURE OF CONTRACTORS' NATIONAL CONVENTION.

Great Enthusiasm Displayed by Members at Opening Session in Milwaukee on Wednesday.

A very striking feature of the opening session of the annual convention of the National Association of Electrical Contractors and Dealers, which was held at Milwaukee on July 16 to 18, was the large amount of work that has been accomplished by the association during the past year and which has been developed to a point where it can be put into effect during the ensuing year. Although the association has been organized for many years, several radical organization changes were made in it during the past two years, the development of which was greatly restricted by the prevailing conditions during the war. However, since the armistice was signed the association has been actively engaged along many lines for the benefit of its membership and the amount of work which it has accomplished is truly remarkable.

The energy and enthusiasm of the members present was evidenced by the lively discussions which took place after each address during the opening sessions and which it is seemed would take place during the remainder of the convention. Over 400 members registered from all parts of the country and, in addition, there were a very large number of representatives of electrical manufacturers, supply jobbers and other electrical interests present who took an active part in the proceedings.

The meeting was opened by P. C. Burrill of the Herman Andrae Co., of Milwaukee, chairman of the Wisconsin State Association of Electrical Contractors and Dealers. In his address Mr. Burrill described the industrial conditions which exist in this country at the present time and which create a great demand for the services of the electrical contractor-dealer. The contractor, however, must do his best to serve the public if he is to reap the benefits of this opportunity.

Mr. Burrill then turned the chair over to W. Creighton Peet, of New York City, chairman of the National Association, who introduced Cornelius Corcoran, acting mayor of Milwaukee. Mr. Corcoran in his welcoming address to the assembled members dwelt upon the features of that city and also upon the patriotism which its citizens had demonstrated during the war. He urged those present as business men to take a more active part in the political affairs of their communities and stated that this was the best means of improving local conditions.

Mr. Peet, in reply to Mr. Corcoran's address, described the work which has been done and which is being done by the National Association. Among the principal features of this work is the Bureau of Education and Research, which has now been fully worked out and which will be put into operation in a very short time. Another feature is an agreement which has been practically completed with the Morris Plan Banks through which the members of the association can secure the necessary financial aid to enable them to sell appliances and wiring on part-payment plans. In addition, the Architects' Committee, the Code Committee and the Insurance Committee have also been particularly active.

During the past year, Mr. Peet stated, the membership of the National Association has been increased 35%, which is the largest increase ever made in one year by the association. This was accomplished in spite of the very unsatisfactory conditions that existed in construction work during this time. However, in order for the association to accomplish the best results it is very desirable not alone that this increase be maintained for the next year, but that a much more rapid increase be made. Mr. Peet also urged the members to read their electrical trade journals more fully and explained that it is only by such means that the electrical contractor-dealer can keep up with the times. In closing, he requested the members to lend their support, and when called upon to perform any services by them they should do so willingly and to the best of their ability.

Franz Nielsen, attorney for the National Association, then spoke on co-operation in business. Mr. Nielsen was at a decided disadvantage on account of having had practically no notice that he was going to talk. His address, however, proved to be very interesting and brought out a number of points on the co-operation idea which should prove of value to the members. He described the growth of the co-operation idea in business and the remarkable position which it holds in the business world today. He also pointed out the fact that without the earnest support of its members no association can succeed and urged the members not to wait until called upon to assist in the conduct of the association's work but to come forward of their own volition and offer their services.

The first speaker at the afternoon session was Frank Stockdale, of Chicago, who spoke on "Keeping Up with the Rising Costs," with particular reference to merchandising. He explained that a large number of merchants do not give the proper consideration to profit and for this reason a large number of them fail. In his opinion the electrical contractor-dealer up to the present time had just been nibbling around the edges of the possible total amount of business. One of the reasons for this is the fact that the electrical dealer has entered the merchandising field from the mechanical side. While this fact unquestionably gives him a better knowledge of the goods that he handles, it does not materially assist him to become a successful merchant. He pointed out that the electrical contractor-dealer's problems cannot be solved by deciding what the other fellow should do but by what they do themselves. The successful merchant, he stated, should be a buyer, seller (which includes displaying, advertising and personal salesmanship), accountant, the manager of his store and its people. It is a difficult matter for one man to be successful

in the first two qualifications especially, since their requirements conflict somewhat.

Merchandise, he stated, should be bought in cold blood and sold with enthusiasm. Too often the opposite conditions prevail and the merchant buys material without giving a thought as to how he is going to get rid of it. He pointed out the advantage which the electrical dealer has over other dealers in displaying his wares. Electrical merchandise from its nature contains the three fundamental attributes of good window displays—color, novelty and action. In spite of this, the average electrical contractor-dealer's show windows are not very attractive. The show window, he explained, is the face of the store and from it the public gets its impression of the store and the merchant. For this reason the merchant should try to keep his show windows as clean and attractive as possible.

He also spoke of the new accounting system which has been developed by the association and stated that in his opinion it was one of the best and simplest he had ever seen. He also briefly explained the cardinal principles of this system. In closing, he pointed out that a merchant gets paid exactly for the kind of work done and if he allows himself to be wrapped up in the details of his business he will never get very far. At the close of Mr. Stockdale's address a lively discussion ensued, during which several interesting facts relative to electrical merchandising were clearly brought out.

Albert Uhl, of Chicago, president of the Chicago Electrical Estimators' Association, then explained the new estimating forms which have been developed by this association. These forms provide a method of figuring an estimate and keeping record of it in an accurate and convenient form. Mr. Uhl's talk was suitably illustrated with lantern slides. E. L. Morley, treasurer of the same association, then described its overhead cost curve, which was described in a previous issue of the ELECTRICAL REVIEW, and a new set of electrical symbols which has been developed by the Chicago Electrical Estimators' Association for use on building plans. The value of the work which has been done by this association and the interest which the members who were present took in it was probably best evidenced by the discussion which followed Messrs. Uhl's and Morley's addresses.

A full report of the remaining proceedings of the association's convention will be given in our next issue.

OHIO ELECTRIC LIGHT ASSOCIATION HOLDS BIGGEST CONVENTION.

Twenty-fifth Annual Meeting, July 15 to 18, the Most Important Held by Organization—Many Vital Problems Discussed.

The twenty-fifth or silver anniversary convention of the Ohio Electric Iight Association, which was held at the Breakers Hotel, Cedar Point, Ohio, on Tuesday to Friday of this week, was declared by all to be the largest gathering in the history of the association. The initial registration was about 550. All of the meetings were largely attended and keen interest was taken in all of the papers, reports and addresses presented; this was shown by the active discussion which followed nearly every topic as it was presented.

The first session on Tuesday morning was opened by the presidential address of I. L. Oppenheimer, of Pomeroy, Ohio, who reviewed the activities of the association during the past year and spoke of the many lines in which substantial headway had been achieved by its various committees. He then took up a discussion of present conditions and problems. One of the needs of the association is increased membership among engineers and companies and he strongly advocated a membership campaign along these lines. The present membership of about 140 companies represents an investment of $20,000,000 in round figures. In conclusion, Mr. Oppenheimer spoke of the numerous benefits of membership in the association.

Following the presentation of the report of the Executive Committee, and of Secretary-treasurer Gaskill and appointment of several committees, there was a round table discussion on the association's work.

The second session opened on Tuesday afternoon with the report of the Station Operating Committee, which was followed by a paper entitled "Daily Unit Data and Cost Systems," by J. M. Strike, of the Acme Power Co., Toledo. A spirited discussion followed in which R. G. Sloat, C. W. DeForest, H. W. Bromley, Wm. Long, H. B. Dates, W. L. Wallau and R. N. Clarkson participated. It was pointed out by several speakers that station records are primarily for attaining economy; therefore, they must be accurate, complete and accessible. It is not so much the form of the records as what they typify that spells their value.

On Wednesday morning the third session opened with the presentation of the report of the New Business Co-operations Committee, submitted by W. H. Matthieu. This outlined the valuable work carried on by the committee at its various sessions in different parts of the state in the face of numerous difficulties. The report covered, among other things, electric welding, the new Ohio State industrial lighting code now in tentative form, refrigeration, industrial electric heating, etc.

Prof. F. C. Caldwell, Ohio State University, discussed the Ohio factory lighting code and urged its importance not only from the standpoint of safety, but of increased production. The requirements of the lighting code must be made known by the central stations acting as a publicity medium. Professor Caldwell explained the present status of the code as not being mandatory but suggestive. Based on the experience obtained in its application, it is expected to make such revision as may be necessary and then make the code compulsory in about two years. He referred to opposition to the code by certain parties, especially in the steel industry, who fear heavy expense in putting it into effect; this is due chiefly to misunderstanding the objects and requirements of the code. He spoke of the educational work undertaken by the Ohio Electric Light Association, the State University and the central stations in teaching the scope of the code and its purpose. Numerous public hearings were held before the code was formulated. Such hearings before formulation of laws have resulted in giving us better and fewer laws than if the laws are first passed and enforcement immediately attempted. In conclusion, he asked for criticisms of the code and for support and publicity of it by the association as a whole as well as by its individual members.

L. G. White, electrical engineer of the Ohio Public Service Commission, in a few words urged more carefully prepared rate schedules for central stations. A uniform rate schedule is needed; this should be

drawn up on a rational basis. He cited examples of inconsistent and improper rates and said that the association is the right organization to take up the matter of standardized rate schedules and discussion of the fundamentals of rate-making. I. L. Oppenheimer also pointed out the vital importance of rates to all utilities, since both company and customer are alike affected.

William McClellan, vice-president of the Cleveland Electric Illuminating Co., made an address on the problems of the days. Local problems have largely been overshadowed by the universal problems of the war, yet an important local problem is the working out of the social upheaval created as the result of the new conditions during and following the war. He said we must all keep our feet on the ground. No real progress is made by revolution but by evolution. It is not what one spends but what one saves that is important. He emphasized the value as a citizen of the property owner, whether of land, home or Liberty bonds. The property owner is a better citizen and not so susceptible to radical social doctrines. He advocated extensive ownership by the public of utility stocks as probably the best means to stop the movement for municipal ownrship. The thrift movement is likely to result in a large part of the public investing in utility securities.

At the fourth session on Wednesday afternoon Col. Ralph D. Cole, Columbus, O., made an intensely interesting address, reciting some of his war experiences. The report of the Meter Committee was presented and discussed. The fifth session was held on Wednesday evening and consisted of a lecture and demonstration by William A. Durgin, Commonwealth Edison Co., Chicago. This dealt chiefly with the productive value of modern industrial illumination. He pointed out its numerous advantages and how readily these may be attained. This lecture was very largely attended by ladies as well as men, about 100 lighting salesmen from Toledo, Cleveland and other nearby cities coming especially to hear it. Mr. Durgin's lecture was followed by the exhibitors' carnival and by a display of moving pictures.

A feature of the convention was the extensive displays made by exhibitors, the exhibition being larger than any ever held at a state convention, it was declared. A report of the sessions on Thursday and Friday will be given in our next issue.

TRACITON LINES NEED A BILLION DOLLARS YEARLY TO MEET DEMANDS.

Interesting Facts Brought Out by Experts in Hearings Before Federal Electric Railways Commission at Washington, D. C.

The problems of the street railways of the United States, which assume a graver aspect from day to day, are being given careful consideration in hearings before the Federal Electrical Railways Commission, created by President Wilson to make a nation-wide study and report means for restoring street railway credit. Experts in this branch of public utility service are at Washington, D. C., appearing before the commission to present the case of the street railways. The testimony of these men bear out some interesting facts on the situation. It was the opinion of W. G. Bradlee, president of the Stone & Webster Management Corporation of Boston, that the traction lines of the country require about $1,000,000,000 each year to meet adequately the demands of the public. He declared that $600,000,000 to $7,000,000,000 new capital was added annually for extensions and improvements, and probably $350,000,000 for refunding of outstanding obligations, and that little has been done in the way of improvements in the last four years owing to unusual conditions. "There are only two ways to obtain this money," Mr. Bradlee said, "either through municipal ownership or through the establishment of some plan so that the private investor will feel that he can count on a reasonable return if he invests in street railway securities."

Guy E. Tripp, chairman of the board of directors, Westinghouse Electric & Manufacturing Co., and chairman of the committee of 100 representing the American Electric Railway Association, in his testimony predicted that many of the larger electric lines would be in bankruptcy before the commission completes its hearings. Mr. Tripp told the commission he believed the fairest method for calculating earnings would be to take the issues of securities, determine whether the money they produced was put in the properties, extract any "water," and use the result. Questioned by members of the commission, Mr. Tripp said great fortunes had been made by street railway corporations in the past, but not through revenues from fares. A return was never paid on a 5-cent fare, he said, but "hopes were capitalized and hopes were sold." He blamed stock watering, high costs of labor and materials, and the present methods of dealing between traction companies and cities for the difficulties of many companies. He said the nickel fare should be made 10 cents and predicted that while the inquiry goes on many companies will go into bankruptcy.

Bentley W. Warren, counsel for the corporation represented by Mr. Bradlee, read a letter from Edward N. Hurley, who was chairman of the United tates Shipping Board, who declared the war showed that adequate and efficient street railway facilities are as essential to cities as transcontinental lines are to the country at large. "They should," declared Mr. Hurley in his letter, "be fostered and safeguarded accordingly. It appears to me that there is only one remedy, and that is authority to increase the fares."

Mr. Bradlee said his company had experimented with gasoline busses and that none of them paid. Asked about Henry Ford's idea that he could solve the street railway problem with a gas car, Mr. Bradlee said Mr. Ford had "an idea and not a car."

DEVELOPMENT OF CENTRAL-STATION SERVICE FOR NEWSPAPERS.

Practically All the Big New York Dailies Are Customers of the New York Edison Company's Service.

The contemplated moving of the *New York Sun*, one of the country's best-known newspapers, to its new and larger quarters in the old Stewart Building, at Broadway and Chambers street, New York City, has brought to light some interesting electrical data. *The Sun* was one of the earliest converts to central-station service among the metropolitan journals, having closed down its own generating plant in 1898, in favor of electric supply from the New York Edison Co. By this act, *The Sun* became the largest customer on the Edison mains and detailed tests were made of its supply and service.

Thus, records show that the lamps used averaged 13.7 cp., with a consumption of 4.11 watts per cp. With the improved types of lamps now available,

The Sun will have a consumption of only about 1 watt per cp., thus obtaining a 400% increase of lighting efficiency during the 21 years of central-station service. In 1898, when *The Sun* abandoned its own lighting plant, the Edison wholesale rate then in effect had a maximum price of 10 cents per kw-hr., with discounts depending on consumption and use, giving possible minimum of 5 cents per kw-hr. for light and 4 cents per hp-hr. for power. With the increased lighting efficiency now available, and the lowered Edison rates since 1898, *The Sun* now gets eight times as much light for every dollar expended as it did 21 years ago.

That *The Sun* became a genuine advocate of central-station service for newspaper use has been twice proved, for when the paper moved in 1915 to the American Tract Society Building, the plant then existing there was also abandoned, and Edison service contracted for. Anticipating the coming move to still larger quarters, Edison service has been adopted for the third time. Additional equipment has been ordered, including new electric melting pots for the linotype machines, while the hydraulic elevators in the Stewart Building will be electrified.

From the standpoint of the central station, it is interesting to note that all but two of New York's big newspapers are customers of the New York Edison Co., the list of journalistic users including the *New York Times, World* (morning and evening), *Sun* (morning and evening), *Globe, Mail, Evening Post, American* and *Journal.* The *Herald* and *Tribune* buildings still maintain isolated plants, but electric supply for the newspapers concerned is protected by large "breakdown" contracts with the New York Edison Co.

FEDERAL TRADE COMMISSION URGES FIXING OF RESALE PRICES.

Recommends Congress to Pass Enabling Act on Resale Prices, Subject to Review by Disinterested Body.

The Federal Trade Commission in a special report to Congress has renewed its recommendation made last December that manufacturers be permitted by law to fix and maintain resale prices, subject to review by a disinterested agency.

The Commission says that such a law would remove present complexity in the business world, promote the efficiency of manufacturing and commercial institutions and serve the interest of the consuming public.

Under this recommendation, manufacturers desiring to fix and maintain resale prices would file with an agency to be designated by Congress, descriptions of their articles, contracts of sale, and the price schedules to be maintained. The disinterested agency would be charged with the duty, "upon complaint of any dealer or consumer or other party at interest," to review the terms of contracts and prices.

The Commission's recommendations, it stated, were based on the following conclusions:

(1) That producers of identified goods should be protected in their intangible property right or good will, created through years of fair dealing and of sustained quality of merchandise.

(2) That the unlimited power both to fix and to enforce and maintain resale prices may not be made lawful with safety; and

(3) That unrestrained price-cutting is not in the public interest, and tends, in the long run, to impair, if not destroy, the production and distribution of articles desirable to the public.

"There must be a common ground," the Commission said, "wherein the rights of producer, purveyor and consumer may each be fully secured and equity done to all. The search for such a ground has been a task of the Commission."

NEW YORK SURFACE LINES TO CHARGE FOR TRANSFERS.

Two-Cent Charge Permitted at 99 Transfer Points for Period of a Year.

Public Service Commissioner Lewis Nixon, of New York City, has issued an order permitting Job E. Hedges, receiver of the New York Railways Co., which operates certain surface lines, to charge two cents for transfers at 99 of the 113 transfer points throughout the city. The order, which is in the nature of a compromise between that demanded by the receiver and the wishes of the municipality, is intended to provide only temporary relief to the surface lines since it will expire on July 7, 1920, one year from the date of issuance. Limitation of the effectiveness of the order to only 99 transfer points was made necessary by the fact that the franchises under the provisions of which the street railways operate specify free transfers at 14 street intersections. The receiver requested permission to charge three cents for transfers, but the municipal officials contended that the necessity for any charge has not been shown.

Commissioner Nixon stated that if at the end of six months the city is not satisfied with the apprasial of the receiver, it is authorized to apply to have this proceeding reopened. The order was made upon condition that the lines of the company are not disintegrated.

AIMS AND ACTIVITIES OF ASSOCIATED GENERAL CONTRACTORS.

First Issue of Members' Monthly News Letter Being Distributed—Association Active in Legislative Work.

The first monthly edition of the Members' News Letter published by the Associated General Contractors of America is now being distributed. The publication contains a brief outline of the organization, its purposes and activities. The association is composed of general contractors, either individuals, firms or corporations, who have been for at least two years in general contracting and who have established a reputation for skill, honesty and responsibility. They must also undertake work in its entirety, partly at least with their own constructing forces.

The objects of the association are to promote better relations between private owners and public bodies, their architects or engineers on the one hand, and contractors on the other; to maintain high professional standards in the conduct of work; to combat unfair practices; to encourage efficiency among contractors; to support contractors and contractors' associations in efforts to rectify conditions of an unsatisfactory character; to encourage those methods of contracting for work which relieve the contractor of improper risks, and to encourage sound business methods tending to raise the standing of contractors generally in the business world.

The association has been actively engaged in legis-

lative work on bills that affect construction activities and has succeeded in having several very satisfactory measures brought up principally with regard to war work. Several committees have been appointed to investigate and report on subjects of interest to contractors and field secretaries have been established in Chicago, New York, Atlanta, Washington, St. Paul, etc., as the first step in establishing closer contacts with its widening membership. It has also undertaken to develop a stand and rental charge on equipment used in construction work and to establish contract forms. In regard to the latter topic, it proposes to make a careful study of existing forms of every kind and in co-operation with the engineers and architects to eliminate unfair practices and to establish clear, definite, and equitable clauses in contracts.

D. A. Garber, North-Eastern Construction Co. of New York City, is president of the association and its headquarters are at 111 West Washington street, Chicago.

ELECTRIC CLUB OF CHICAGO TO HAVE BIG OUTING.

Eleventh Annual Basket Outing at Ravinia Park—Athletic Events, Music and Other Attractions.

Following its annual custom, the Electric Club of Chicago will have an all-day outing at Ravinia Park, about 20 miles north of Chicago, on August 21. As usual, a very large number of prizes have been donated by electrical firms of Chicago and these will be awarded for a great variety of races and other athletic contests for the children as well as adults and also for certain guessing contests for those not in condition to engage in strenuous athletic effort.

The committee in charge of the outing announces that for those electrical men who are unable to attend the outing personally special arrangements will be made to take care of their families so that they may be represented. The tickets to the outing will also permit members and their families and friends to stay for the grand opera performance in the evening, if they so desire, this being a regular feature of the evening programs that has made Ravinia Park noted in the Chicago district.

REFUSE COLLECTION BY ELECTRIC TRUCKS FOUND ECONOMICAL.

Experience of City of Sheffield, England, Very Satisfactory—Plans to Use More Electrics.

J. A. Priestley, cleansing superintendent of Sheffield, England, has prepared an improved scheme for collecting and disposing of house refuse, which will require four additional motor vehicles or 12 horses and wagons. According to the *London Electrician,* he states that the experience of the past four years with electric vehicles has been eminently satisfactory, and has demonstrated that the work can be done by their agency more expeditiously and economically than by horse labor. For house-to-house collection work the electric vehicle cannot be approached by gasoline motors. Steam wagons approach more nearly to the electrics in suitability and economy, but the latter possesses advantages in noiselessness and ease of maneuvering that are not shared by steam wagons, and require also the services of one man only to drive them, and that not necessarily a skilled man. The total weight of refuse collected in the city during the past year was 110,855 tons, an average of 2131 tons per week; but, as the amount varies as between summer and winter, the maximum amount to be collected during the heaviest period of the year is about 2600 tons weekly.

To collect this quantity of refuse by electric vehicles will require about 60 electrics, or, allowing a 10% margin to cover breakdowns, 66 vehicles would be necessary. The city has at present 12 vehicles in use and three on order, and the full program would therefore require the provision of 51 additional machines. For charging the batteries of this number of vehicles three 100-kw. motor-generators would be required, in addition to present charging facilities, and, as a stand-by machine is imperative, four generators of this capacity should be provided. Charging panels, switchboards, measuring instruments, etc., would also be required in proportion to the vehicles, and the total cost of the equipment would be about $500,000.

GENERAL ELECTRIC'S CONTROL OF TRUMBULL COMPANY CONFIRMED.

Trumbull Electric Manufacturing Co. to Retain Name and Management Though Controlled by General Electric Co.

The statement in our issue of last week respecting the acquirement of controlling interest in the Trumbull Electric Manufacturing Co. has been confirmed by the following official announcement:

"The General Electric Co. has acquired an interest in the Trumbull Electric Manufacturing Co., of Plainville, Conn. The present management of the Trumbull Electric Manufacturing Co. still retains a financial interest in the company and will continue in active charge of its manufacturing and selling policy.

"The Trumbull Electric Manufacturing Co. has an enviable reputation, national in its scope, as large manufacturer of knife switches and safety-first iron-box enclosed switches, as well as a general line of miscellaneous supplies, and the General Electric Co., believing in the great future of the safety-first movement, feels that an alliance between these two leading manufacturers of goods designed to promote the safety-first feature in service-entrance switches, motor-control devices, etc., will give considerable satisfaction not only to the present customers of the Trumbull company, whose name will remain unchanged, but to the trade in general."

AERIAL MAIL DELIVERY OF LAMPS STARTED BY EDISON LAMP WORKS.

New Mazda C-4 Lamp Shipped Safely About 500 Miles Within Twelve Hours.

Tuesday, July 8, marked the new day in the transportation of lamps from manufacturers to distributors. On that day, the Edison Lamp Works of General Electric Co., Harrison, N. J., delivered to the Republic Electric Co., Cleveland, Ohio, one of the new Mazda C-4 tipless lamps, via aerial mail service.

The regular mail plane left Belmont Park, New York, at 5 a. m., arriving in Cleveland about noon, and the lamp was delivered to Louis Griesser, president of the Republic Electric Co., in good condition, through the regular post office channels.

The transportation department of the Edison Lamp Works announces that it is now ready, in cases of emergency, to make delivery of lamps by airplane in

all sections of the country covered by the Government aerial mail service.

It is expected that Heller Field at Newark, the largest Government landing field for aerial mail service in the East, will be ready for use shortly, and this will make for even quicker service.

Packages shipped by aerial mail are limited to 30 in. in length and girth.

NEW SUBWAY LINK OPENED IN NEW YORK CITY.

Train service on the new extension of the Brooklyn Rapid Transit subway between Times Square and Fifty-seventh street in New York City was initiated at midnight on July 3. The extension of the service to Fifty-seventh street is the addition of another link in the line from Coney Island through Brooklyn to lower Manhattan, and along Broadway and Seventh avenues to Central Park, then east to Long Island through the Sixtieth street tunnel under the East River. Local train service will be maintained north of Times Square. Express service will be maintained between Times Square, Manhattan, and Pacific street, Brooklyn.

The service is expected to be extended to Sixtieth street and Lexington avenue before September 1, and through the Sixtieth street tunnel to Queensborough Plaza soon after January 1. Track laying in the tunnel section of the line, which was started about July 1, is expected to be completed in about four months.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS.

From a technical point of view, the Chicago meeting of this Institute, Sept. 22 to 26, inclusive, promises to be one of the most interesting in its history. The wealth of material in the line of technical papers for discussion is greater than has been offered for any previous meeting; upwards of 150 papers have been submitted to the committee, which finds it no small task to arrange a program to present this number with a minimum of conflicts among papers on allied subjects.

One of the excursions to be made by the Institute as a body during this meeting is to the LaSalle district. A special train leaving Chicago early Thursday morning will take the members and guests to LaSalle, Ill, where automobiles will convey the different parties to the coal mines, cement works and zinc smelters; for the ladies and others of the party not particularly interested in these industrial operations, the LaSalle hosts plan an automobile trip to Starved Rock and nearby points of scenic and historic interest.

BROOKLYN TRANSIT RECEIVERSHIP COVERS SURFACE LINES ALSO.

The Brooklyn Rapid Transit receivership was extended on July 14 by Federal Judge Julius M. Meyer so as to place Lindley M. Garrison, the receiver, also in charge of the surface railways in Brooklyn. Previously only the Brooklyn Rapid Transit Co. and the elevated and subway lines of that system were included in the receivership. The extension was made to cover the Brooklyn Heights Railroad Co., the Nassau Electric Railroad Co., the Brooklyn, Queens County & Suburban Railroad Co., and the Coney Island & Brooklyn Railroad Co., which, through leases, virtually control all Brooklyn Rapid Transit lines to Brooklyn.

PUBLIC SERVICE RAILWAY EMPLOYES GRANTED INCREASE.

The employes of the Public Service Corporation of New Jersey that operates the street-railway systems in Jersey City, New Brunswick, Edgewater, Paterson, and other nearby municipalities have accepted the award of the War Labor Board granting increases in wages. The men demanded 65 cents an hour and an eight-hour day, but were granted ten hours' pay for nine hours' work. The award amounts to about 55 cents an hour, an advance of 5 cents. The decision made the pay retroactive to May 1 and directs the corporation to pay about $30 to each of its 4500 employes.

LORAIN INAUGURATES BUILDING CAMPAIGN.

With 200 houses under construction, a campaign has started in Lorain, O., which has as its slogan: "A Thousand Homes This Summer." Houses are being rented before the ground is broken.

J. B. Johnson, general manager of the Lorain County Electric Co., a Doherty property, reports that building activity is also going on in Elyria at a rapid rate. Over eighty homes are under construction there and permits recently have been issued at the rate of ten a day.

COPPER SUBSTITUTES FORBIDDEN FOR ELECTRICAL WORK IN NORWAY.

The shortage of copper, from which all Norway, but especially the electrical works of that country, has suffered through war conditions, no longer exists. America is now in position to deliver the whole of the metal purchased long ago on Norwegian account. In consequence of this, the electrical works at Christiania have forbidden the continued use of zinc and iron as electrical material. From July 1, 1919, only copper is to be used for electrical purposes. The imports from America will include large quantities of line wire.

SMELTER PRODUCTION OF COPPER DURING THE YEAR 1918.

The smelter production of primary copper in the United States during 1918 was 1,908,500,000 pounds, which, if compared with the production in 1917, 1,886,000,000 pounds, shows an increase of 1.17%. The total value of the output in 1918, at an average price of 24.7 cents a pound, is $471,408,000, against $514,911,000 for 1917.

ELABORATE PLANS MADE FOR BRITISH PEACE ILLUMINATION.

The British Electrical Development Association held a meeting in London on July 1 to consider the following points: (1) Provision of lamps for peace illuminations; (2) provision of strip devices and other material; (3) rates to be charged by electricity supply undertakings; (4) provision of additional or heavier service connections where required.

Commercial Practice

Rapid Increase in Power Load — Electrics Meet Favor in Delivery Work—Employes' School of Dayton Central Station

PUBLIC SERVICE COMPANY INCREASES LOAD BY 9809 HP. IN FIVE MONTHS.

Large Increase in Load Contracted for by Public Service Co. of Northern Illinois.

New electric power business contracted by the Public Service Co. of Northern Illinois in the period between Jan. 1 and May 31 this year amounted in the aggregate to 9809 hp. In the same period of 1918 the total was 4398 hp. and in 1917, 5900 hp. Thus the total of each of the previous years' first five months' business was greatly exceeded. Considerably more than half the power load which it was calculated should be secured in 1919 was entered up in contract form in these five months. In detail the figures which represent 382 contracts are as follows:

	Jan. 1 to May 31, 1919.	1919 Allotment,
Division.	Hp.	Hp.
A	3301.3	3000
C	354.2	2000
D	1066.5	3000
E	109.2	500
F	3176.2	3000
J	1109.9	3000
K	231.0	1000
L	114.0	250
O	95.1	100
R	135.1	150
S	117.3	1000
Total	9809.8	17000

Numbers of the contracts made were for large amounts of energy, some of them providing for big installations with exceedingly heavy connected loads. It is interesting to note that of the total figures shown in the list, 95 hp. represents the demand made by electric ranges installed. Not appearing in the table of new business there were also renewals of contracts for the same purpose reaching 309 hp.

In the month of June the company kept up its stride and landed new customers whose power requirements reached upwards of 1500 hp. Among these is the Construction Materials Co. at Waukegan for about 600 hp. in which installation a 500-hp. motor will be put in service. The Armour Fertilizing Works at Chicago Heights were connected up for 700 hp. to be employed in uses requiring a number of different sized motors. Other contracts included one for 75 hp. with R. F. Conway & Co. at La Grange, and one with the Oak Park Baking Co. at River Forest for 82 hp. additional.

ELECTRIC TRUCKS IN DEPARTMENT STORE WORK.

Gimbel Brothers, New York, Augment Their Electric Vehicle Fleet.

Gimbel Brothers opened their New York department store in 1910. At that time they purchased a fleet of 88 electric trucks. In 1918, after eight years' use of electric transportation, they purchased 11 additional electric commercial vehicles, and in the early part of 1919 further augmented their fleet by 9 additional electric trucks.

The nationally known department store business of Gimbel Brothers has been served adequately by electric transportation for a period of approximately ten years—long enough for a comprehensive trial. The best proof that the electric truck has made good is the repeat orders by this concern whose success in business is largely dependent on efficient, economic, dependable transportation—the sort rendered by electric trucks.

The electric commercial vehicle is the standard mode of transportation as employed extensively by many of the great department stores in this country and abroad. For example, Marshall Field & Co., Chicago, Ill., uses 264 electric trucks, while Harrods, Ltd., London, England, employs 72. Space does not permit a complete list of department stores using large electric vehicle fleets, but the above may be taken as indicative. The "electric" has proven, by long experience, that it is the ideal truck for such frequent-stop transportation service.

PITTSBURGH NEWSPAPER ADOPTS BIG ELECTRIC SIGN.

Sixty-four Thousand Candlepower Sign Lights Up Newspaper Office.

A large electric sign has been installed upon the roof of the Highland Building, Pittsburgh, Pa., by the Duquesne Light Co. The sign advertises two of Pittsburgh's daily newspapers, namely, the *Morning Gazette Times* and the *Evening Chronicle Telegraph.*

The sign, which is illuminated on three sides, is rated at 64,000 cp., and contains 3200 25-watt lamps which consume 80,000 watts per hour, or 150,000,000 watts per annum. Each letter is 10 ft. in height. The Highland Building is the tallest structure in the East End section of Pittsburgh. The illumination from this sign improves the lighting of the streets for several blocks and can be seen for a radius of 10 miles. Energy for lighting is furnished by the Duquesne Light Co.

ENERGY CONSUMPTION INCREASES TWICE AS FAST AS POPULATION.

In his presidential address to the Pacific Coast Section of the National Electric Light Association at its recent convention in California, Samuel Kahn, vice-president of the Western States Gas & Electric Co., said:

"Not long ago a statistician compiled figures to indicate that the number of kilowatt-hours of electricity used increases more rapidly than the square of the

population; in other words, if the population is doubled the energy consumption is more than quadrupled. Therefore, if the population of the Pacific Coast doubles within the next ten years, the use of electricity will be four or five times as much as at present. Figures recently published by the Bureau of the Census, Department of Commerce, indicate that the central stations of California during the year 1917 generated 2,746,000,000 kw-hr. of electrical energy as against 661,000,000 kw-hr. in 1907, an increase of 315%.

"These figures bear out the statement regarding the consumption of electrical energy and should be instilled in the minds of every thinking man and woman, for they must come to realize that the solution and responsibility of furnishing this energy rests with men trained to that particular industry, as they are in position to render that service, taking all factors into consideration, at less cost than a governmental agency."

ELECTRICAL SCHOOL OF DAYTON POWER & LIGHT COMPANY OPENED.

The co-operative school of the Dayton (O.) Power & Light Co. opened July 1 with 18 high-school graduates in the class. They will be given a thorough course in electricity and then later trained in the different branches of the company to which they seem most adapted. Some will enter the sales department, where a thorough course of salesmanship will be given them. The others will take a finished course in meter construction, testing, etc. This school is open to any high-school graduate and he is paid 30 cents an hour while attending the school and will later be placed in

Student Class of Dayton Power & Light Co.

some department of the company and his advancement is assured. This school was found to be absolutely necessary by O. B. Reemelin, general superintendent of the company, on account of the rapid growth of the company and because of the shortage during the past two years of young men owing to the war. Those finishing the course and passing an examination will be able to take a position in the department to which they show adaptability that would otherwise require a year or more time in the regular way of working. The Dayton Power & Light Co. is supplying service to some 46 communities such as Dayton, Piqua, Xenia, Wilmington, Jamestown and Germantown. It is operating three city car lines in Dayton and one suburban line, also 85% of available factory business in Dayton and other cities it serves.

During the war the Dayton Power & Light Co. supplied all the power used in the manufacture of war munition. It also is supplying power for all the Conservancy work, going so far as to operate the motors on the dredges at present engaged in straightening the Great Miami river.

UTILITY COMPANIES RESPONSIBLE FOR MOST OF OUR COMFORT.

Paul Tomlinson in *McClure's Magazine*, says:

"We have the public service corporations and the public utilities companies to thank for supplying us with most of the things which make our lives so comfortable. When we press the button which controls the electric lighting in our homes do we stop to think that at the heart and center of the maze of wires, over which runs the current responsible for our light, there is a great power house? That this same plant perhaps is sending out the power which carries us along so swiftly in subway trains or electric cars? That this power plant is the basis of a great industry, the result of modern science, industry and engineering skill? It may be that a great river has been harnessed and Nature made to work for us. Who knows the imagination, courage, and labor which have made it possible for us to live and travel about in comfort and convenience?"

SPARE-TIME SALES STIMULATE APPLIANCE BUSINESS.

The experiment tried out by the Public Service Co. of Northern Illinois some time ago, of giving commissions for appliance sales made by employes during spare time, has proved very successful. The offer applies only to employes outside of the sales department and the result has been not only increased sales of all kinds of appliances but greater interest on the part of all employes in the development of new business. Many leads are furnished the regular sales force by employes who heretofore paid little or no attention to company business outside of office hours.

As an indication of the direct results of the plan, four employes sold appliances valued at practically $6000 during the 6 months ended July 1, all sales being made during spare hours.

WHAT THE ELECTRIC STEEL FURNACE MEANS TO CENTRAL STATIONS.

The war brought forcibly to the fore the value of the electric furnace for steel making and refining because the demands of war create severe requirements that steel must meet. And steel made electrically meets the conditions imposed.

There are at the present time some 330 electric furnaces for steel production in this country. These furnaces consume about 750,000,000 kw-hr. when operating at capacity and are able to produce about 1,400,000 tons of castings and ingots.

A FAN FOR EVERY SLEEPING ROOM.

Henry L. Doherty has said that he would consider himself a great humanitarian if by his efforts there was an electric fan used in every sleeping room in the country, his idea not entirely being from the standpoint of promoting electricity, but for the promotion of that very inexpensive commodity known as "fresh air."

Operating Practice

Moisture Content of Coal — Cleaning Condensers — Boiler Tests with Powdered Coal — Problem of Neutral Current

VARIATION OF MOISTURE CONTENT OF COAL IN TRANSIT.

Tests Show Variation With Grades of Coal and With Seasons.

In transit between coal mine and power plant or point of consumption, coal is subjected to the influence of the elements. All coal, until treated, contains moisture. Coal in transit contains moisture, and whether the moisture content increases or decreases in transit depends upon several factors, the chief of which are the weather, the time the coal is in transit, the form in which the coal is shipped, and the distance of travel.

Some companies pay for their coal and the freight charges as weighed at the mine, others pay for the coal as weighed by the railroads at the point of delivery. In other instances, of which there are only a few, the coal and the freight charges are paid according to the weight as determined by the central station at its power houses. While this latter is most uncommon, it is the method in vogue with the Commonwealth Edison Co., one of the largest consumers of coal in the central-station industry.

This company has carried on extensive tests to determine the variation in moisture of coal in transit from the mines to its generating stations. A large number of samples were taken at the mine and when delivered, and the moisture content in both instances determined. The accompanying diagram shows the variation of moisture content of several different coals during the different seasons of the year.

The tests extended over a period of some 14 months and have shown that the average moisture content of coal as unloaded at the generating stations during the year varies but little from the moisture content as loaded at the mine. The moisture content does, however, vary with the seasons. For example, samples taken from Sept. 1 to Dec. 31 showed an average increase of moisture content of 0.34%; from Jan. 1 to March 31, an increase of 0.70%; from April 1 to June 30, a 0.12% increase, and from July 1 to Sept. 30 an increase of 0.28%.

A further instance of the changes with the seasons is afforded by comparison of the moisture content of coal unloaded during September and October of two consecutive years, shown in the following:

	Total precipitation.	Moisture in coal.
September of two consecutive years..	3.53	13.7
	2.24	13.0
October of two consecutive years....	0.40	13.4
	3.85	14.1

Coals from different localities behave differently as regards absorption of moisture. It was also found that the amount of moisture retained by saturated screenings depends both upon the relative quantity of fine particles and the nature of the coal.

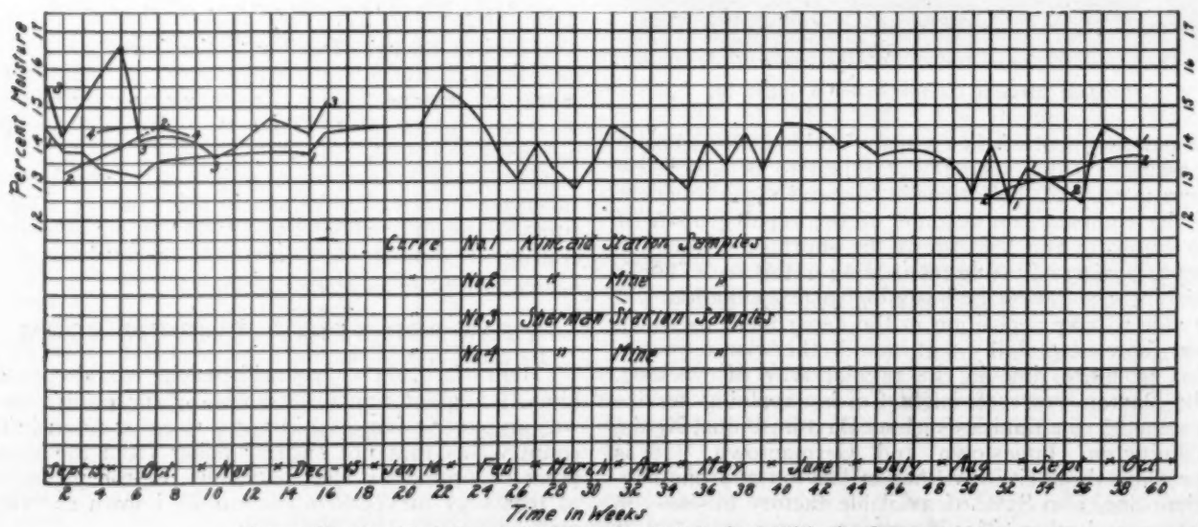
Greater differences were found between coals from northern and southern fields than between samples of the same coal having wide variation in average size.

SAND IN CIRCULATING WATER CLEANS CONDENSER.

Periodic Treatment With Sand Delays Growth of Deposit in Tubes.

The problem of cleaning surface condensers is often a difficult one, because of the large number of tubes requiring cleaning and because of the short time available between the time a machine can be taken out of service and when it must be ready again.

The use of compressed air and sand, compressed


Percent Moisture
Curve No1 Kincaid Station Samples
No2 " Mine "
No3 Sherman Station Samples
No4 " Mine "
Sept 15 Oct. Nov Dec. 15 Jan 16 Feb March Apr May June July Aug Sept Oct
Time in Weeks

Curve Showing Variation of Moisture Content in Coal With the Seasons.

air and a wad and the wire brush are some of the methods employed for cleaning the inside of tubes. The use of kerosene is also adopted sometimes. All these methods, except that of employing kerosene, necessitate taking the machine out of service and necessitate a somewhat protracted delay.

A method that has been employed with considerable success in some cases is to maintain a gradual cleaning process during operation. This can be done in the following manner. Sand is introduced into the condenser with the cooling or circulating water. About 1.5 cu. yd. of sand per day or thereabouts seems to suffice when this treatment is kept up for about three weeks. The tubes can be kept fairly clean in this way without the condenser being taken out of service. Such treatment might enable higher vacua to be maintained during the summer months and at other times where capacity does not permit of units being taken out of service for cleaning.

Experience will show the minimum amount of sand required for a given velocity of water through the condenser. More than this should not be used because of the scouring action of sand and its effect of reducing the life of the tubes.

BOILER TESTS WITH PULVERIZED COAL AS FUEL.

Operating Results Obtained on 468-Hp. Boiler Show High Efficiency.

The following report of a test of a 468-hp. water-tube boiler was presented by N. C. Harrison in his paper entitled "Pulverized Coal as a Fuel" read before the June meeting of the A. S. M. E. in Detroit. The installation is noteworthy not only by reason of the high efficiency obtained, but also because of the fact that it has made clear some of the conditions necessary for the successful operation of boilers utilizing powdered fuel.

When the boiler was first put into operation, a number of undesirable conditions resulted. An insufficient air supply caused high-furnace temperatures resulting in fusion of the ash particles and a consequent accumulation of slag between the tubes, on the furnace walls and in the ashpit. The removal of the molten slag presented considerable difficulty. It was also found that the combustion chamber was of insufficient size. High gas velocities resulting from insufficient air in the chamber tended toward destruction of the refractory surfaces of the furnace.

A new furnace was, therefore, designed. The combustion chamber was enlarged and a regulated air supply was provided for by means of a number of auxiliary air openings equipped with dampers. The accumulation of slag in the pit was prevented by raising the point of admission of the fuel into the furnace. As a result the flame path has been raised above the base of the pit, hence particles of ash dropping from the flame are not fused. The ash, therefore, can be drawn from the pit in the form of a powder and small slugs of slag. Analysis has shown that the ash contains practically no carbon.

Having established satisfactory furnace-operating conditions, a series of efficiency and capacity tests were conducted preliminary to proving the contract guarantees. The brickwork was then given a thorough trial by carrying the boiler at a continuous rating of 180% over a period of several days. On August 12 and 13 a final efficiency test, the results of which are given below, was run. The boiler is a three-pass water-tube 468-hp. boiler, equipped with a superheater.

LOG OF TEST OF A PULVERIZED-FUEL-BURNING STATIONARY BOILER.

Make of boiler	Edge Moor
Rated hp.	468
Heating surface, sq. ft.	4,685
Time fired or test started	11:15 a. m. 8/12/18
Time fire out or test finished	11:15 a. m. 8/13/18
Duration of test	24 hr.

	Maximum.	Minimum.	Average.
Temperature of boiler room (deg. F.)	99	85	93.3
Temperature of feedwater	168	135	157.2
Temperature of steam (deg. F.)	477	427	448.7
Barometer in. of mercury	29.35	29.20	29.25
Temperature of flue gases (deg. F.)	515	455	495.3
Average boiler pressure, lb.			167.0
Atmospheric pressure, lb.			14.4
Temperature of steam, deg. F.			373.8
Superheat, deg. F.			74.9
Safety valve set for, lb.			175
Fuel fired per hour, lb.			1,990.6
Total fuel, lb.			47,775
Total water, lb.			393,168
Water apparently evaporated per hour, lb.			16,393.0
Water apparently evaporated per lb. of coal, lb.			8.23
Factor of evaporation			1.1502
Water evaporated from and at 212 deg. F. per lb. of coal, lb.			9.47

	Maximum.	Minimum.	Average.
Corbon dioxide (CO_2), per cent	15.4	12.2	13.85
Oxygen (O), per cent	5.6	3.2	4.38
Carbon monoxide (CO)			None
Fuel used			Bituminous screenings

Fuel analysis	No. 1	No. 2	No. 3	Average
Amount of coal represented by each sample, lb.	19,775	20,000	8,000	.....
Per cent of total	41.3	41.1	16.9	.....
Moisture (per cent)	10.3	11.0	9.7	10.49
Volatile (per cent)	23.81	36.96	38.77	35.96
Fixed carbon (per cent)	50.43	49.13	48.29	49.53
Ash (per cent)	14.36	13.91	12.94	13.93
Sulphur (per cent)	1.90	2.06	2.12	2.04
B.t.u. as received	10,600	10,763	11,263	10,779
B.t.u. dry	11,817	12,093	12,473	12,045

Vacuum in burner, in.	0.006
Vacuum under primary arch, in.	0.000
Vacuum in combustion chamber, in.	0.000
Vacuum in first pass, in.	0.000
Vacuum in second pass, in.	0.0057
Vacuum in breeching, in.	0.09
Feeder speed, r.p.m.	(No. 1), 53.6 (No. 2), 50.7
Coal per rev. of screw, lb.	0.318
Accumulation of slag on tubes	None
Flues blown during test	5 times
Operation of furnace	Very satisfactory
Pulsation	None
Condition of smoke	Light
Heat effect on brick	None
Back lash of flame in burner	None
Pounds of steam per hour from and at 212 deg. F.	18,842.6
Horsepower	546.2
Per cent of rating	116.7
Boiler efficiency, per cent	85.22
Memoranda—Fuel-preparation deduction:[1]	
Coal used in drier, lb.	1.140
Motor operation	449.3 kw-hr.
Coal equivalent at 3 lb. per kw-hr., lb.	1,348
Total deduction, lb.	2,488
Resulting net efficiency, per cent	81.1

[1]No deduction made for stand-by losses in drier.

NEUTRAL RESISTANCE REDUCES INDUCTIVE INTERFERENCE.

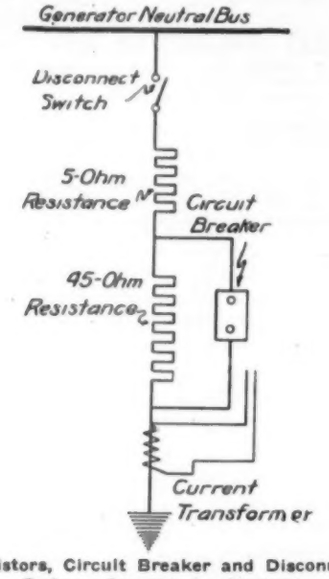
Reducing Neutral Current by Resistance, Problem of Relay Performance.

By B. M. Smith.

The problem of dealing with inductive interference between heavy current lines and small-current lines, the one for transmitting power and light and the other for telegraph and telephonic messages has received much attention of recent years due to the ramifications of both forms of lines and the frequency with which these lines come into close proximity to one another. Both the A. I. E. E. and the N. E. L. A. as well as a number of public service commissions have taken up the subject of inductive interference. The subject is, therefore, a live one among operating engineers, both central station and telephone and telegraph.

In a recent instance that came to the attention of

the writer complaints had been made that a high-voltage power transmission line was causing considerable noise in a telephone line during certain periods. The transmission line paralleled the telephone line, which was an important trunk line, for about 2 miles. This transmission line ties two generating stations together, these two generating stations being on different systems although operating in parallel. The noise in the telephone line was greatest when both stations were running together and the neutral at each station



Layout of Resistors, Circuit Breaker and Disconnect Switch to Reduce Current in Neutral.

was closed to ground (the generators were star-connected machines, the units being turbogenerators). The noise was much less with the neutral of only one of the stations closed, and a minimum when both neutrals were open.

Finding the Cause of Inductive Interference.

The high-voltage transmission line consisted in part of aerial conductors and in part of underground cable. The aerial conductors were located in an equilateral triangle, an arrangement that tends to reduce induction and unbalanced static conditions between phases to a minimum.

The inductive interference commenced as soon as the transmission line between the two generating stations was placed in service, which was in the early spring. As it was at first thought the insulators might be the cause (before the effect of varying the neutral circuit at the generator stations was experimented with), these were tested and examined. Spring rains clean insulators and the sun dries them; cracks and broken petticoats on the other hand are weak places that cause leakage, which causes static interference with telephone wires in proximity. All insulators found defective were replaced with no effect upon the noise in the telephone lines.

Experiments with the neutrals of the generators showed that with both neutrals open the noise was a minimum, a maximum when both stations had their neutrals closed and somewhere between these limits when only one of the stations had its neutral closed to earth. It was also found that there was less noise with certain generators operating at each station with their neutrals closed to ground than when other generators were operated in the same way. The larger and more modern units created the least disturbance to the telephone lines. The distribution of load between stations and variation of total load seemed to make little if any difference in the noise induced in the telephone line.

The phenomena immediately suggested that the inductive interference was caused by the interchange of circulating current between the two generating stations, due to differences in wave-form, phase displacement, and, mostly, to the triple-harmonic current that would be short-circuited through the generators when the neutral at each station was closed. The wave-form at both stations was good and it was the consensus of opinion that it was the triple-harmonic that was the cause of the trouble.

Overcoming the Triple Harmonic.

By installing resistance in the neutral circuit it was found that the third-harmonic current could be reduced to such a value as to make the disturbance in the telephone lines almost disappear. Unfortunately the resistance that it was necessary to insert in the neutral circuit was of such a value that overload relays would not function when short circuits occurred in the underground cables between phases and sheath.

A recording ammeter was installed in the neutral to show the variation in circulating current through the earth. Measurements of effective resistance were taken to determine the resistance of the circuit between generating stations that the circulating current followed. It was found that the minimum resistance permissible if the relays were to be depended upon was about 5 ohms. On the other hand to reduce the noise in the telephone circuit to such a value that the telephone company were satisfied it was necessary to insert about 50 ohms in the neutral.

As telephone interference could not be tolerated nor could the idea of foregoing the protection of the overload relays it was decided to adopt a selective action by which the neutral current would be kept to the minimum where the telephone company were not interfered with during normal operation and yet where the neutral current would be able to increase during short circuits to sufficient value to enable the overload relays to function. In other words a resistance of 50 ohms was inserted in circuit during normal operation and so connected that it would be automatically taken out of circuit and leave only resistance of 5 ohms in circuit, when the relays functioned.

The above arrangement is obtained by employing two banks of resistance, namely 5 and 45 ohms respectively. The 45-ohm bank is shunted by a circuit breaker controlled by a current transformer located in the neutral circuit so that all neutral current passes through it. When a short circuit occurs between some phase and ground the current transformer operates to close the circuit breaker, which thereby cuts the high-resistance resistance bank out of circuit so far as affects the resistance of the neutral circuit, hence flow of neutral current. The relays then function because instead of 50 there is only 5 ohms in circuit.

In the diagram a disconnect switch is shown, the purpose of which is to enable the banks of resistance and current transformer to be isolated from the generator neutral bus should it be necessary to work on them. A spark gap may be inserted across the 50-ohm bank, but it plays no part in the reduction of inductive interference with the telephone line, but is used as a precaution to protect the underground high-voltage cable between generating stations, and of generators and station apparatus in case potential rises.

Contracting-Construction

Chicago License Fees to Be Raised—Lighting to Make Bank Building Conspicuous—Electrical Supplies for General Use

PROPOSED CHANGES IN CHICAGO CONTRACTORS' LICENSE LAW.

Ordinance Providing for Increased License Fees Expected to Bring Desirable Results—Inspectors' Salaries Raised.

An ordinance providing for several changes in the existing law governing the licensing of electrical contractors in Chicago was recently approved by a subcommittee of the City Council Judiciary Committee. The new ordinance which was drawn up by the local municipal inspection authorities in co-operation with the fixture manufacturers, contractors, and the local labor organization, is expected to do a great deal toward improving electrical contracting conditions in Chicago.

The principal change in the proposed ordinance is in the licensing fee, which has been considerably increased and divided so that different fees are charged for the various classes of work done. The present law provides for a charge of $25 for the original license with an annual renewal charge of $10. This license covers all classes of work. Considerable difficulty has been encountered due to the fact that this charge was so low that many electricians who were not strictly contractors could well afford to carry such a license, although actually employed as journeymen and do contracting work on the side. This not only made unfair competition for the legitimate contractor but caused trouble with customers, for no means were provided other than a revocation of the license which would force such men to install approved wiring. As a result many people were forced to have their wiring changed or repaired by another contractor after the work was supposedly completed. Furthermore, it is obviously unfair to charge the same license fee for all classes of work.

The new ordinance provided for the following license fees: General license, which enables the holder to do all classes of electrical work, $200, with an annual renewal charge of $50; electrical construction license, which allows the holder to do all kinds of construction work but does not include permission to manufacture or install fixtures, $100, renewal $25; fixture hangers' license, which permits the manufacture and installation of fixtures only, $100, renewal $25; sign license, which allows the erection and wiring of electric signs only, $25, renewal, $10; maintenance license, which allows the holder to make minor changes, repairs or alterations in existing wiring, $25, renewal, $10. The ordinance also provides for a surety bond which the applicant must secure and which insures the customer a proper installation but does not make the city responsible for the work. In addition, an examining board composed of representatives of the various branches of the industry will be established to determine the applicant's ability and responsibility. No license can be procured without the approval of this body.

The new ordinance further provides for changes in the payment of inspection fees. At present the fees are paid only by the electrical contractor, who is charged on a graduated scale per socket, for lights, or per horsepower. The fixture dealer is obliged to take out a permit for the fixture work but does not have to pay any fee.

Under the new ordinance the electrical contractor's fees will be based upon the circuit capacity to which will be added an additional fee for any drop cords, baseboard or wall receptacles that his men may install. The fixture dealer is also required to pay an inspection fee which will be based upon the number of sockets installed. The advantage of this new system is that the electrical contractor is enabled to determine more accurately the amount of his inspection fee when it is determined by the work which he installs. Under the old procedure this could not be ascertained until the fixtures were installed. As the inspector's approval could not be secured until this fee was paid it often delayed the use of the service.

At present the proposed ordinance is awaiting the approval of the Judiciary Committee and it is hoped that action will be taken immediately before the City Council adjourns for its summer vacation. Although some change will probably be made before it finally becomes a law it is expected that the ordinance will be approved and that as a result the electrical contracting conditions in Chicago will be considerably improved.

The Finance Committee of the City Council recently approved an increase in the salaries of the electrical inspectors. The bill provides for a yearly wage of $2400 dating back to Jan. 1, 1919, with a further increase to $2580 per year starting in August, 1919. The number of district inspectors was also increased to 44.

EXTERIOR LIGHTING OF BANK BUILDING PROVES SUCCESSFUL.

Contractors Often Neglect Opportunities in This Field—Features of Recent Installation.

Nearly every electrical contractor appreciates the value of outline or flood lighting on a building as an advertising feature, yet very few of them make any attempt to encourage the installation of such lighting unless the customer first requests their assistance. Perhaps the best field for such work is in the lighting of buildings occupied by firms that do a large amount of advertising but from the nature of their business do not have any use for display windows. Such firms for example, as banks and real estate offices, have nothing to display other than placards and very often have dark and forbidding exteriors. Such firms, however, are large advertisers and the electrical contractor will not have much difficulty in persuading them to install some form of exterior lighting, if he tries.

Although flood lighting is generally to be preferred

for such work there are many cases where it is necessary or desirable to install a system of outline lighting on the building. Such a system was recently installed on the Peoples' State Bank building at 47th street and Ashland avenue, Chicago, by J. L. Burgard, an electrical contractor of that city, and has proven very satisfactory to the bank officials.

The building occupies one of the five corners formed by the intersection of three streets at this point. However, it was somewhat obscured because this particular corner set slightly back of the others, which were occupied by brilliantly lighted stores with attractive display windows. It was not considered advisable to install a flood-lighting system as it would be rather difficult to control it and some of the other building owners would not permit the flood lights to be installed on the roofs of their buildings.

The outline lighting as installed consists of 800 Cutler-Hammer Norbitt receptacles containing 25-watt Mazda B lamps arranged in a row along the top of the building. These receptacles are mounted on a channel-iron framework which extends about 12 in. out from the edge of the roof. In addition, 12 3-light showers equipped with 100-watt C lamps were installed at intervals about 2 ft. above. Over the main entrance to the building, which is triangular in shape, the system drops down to the level of the ceiling of the first floor and terminates at a flashing sign. All the sockets used were of the approved weatherproof type. The shower fixtures were also made by the Burgard company and are constructed entirely of conduit, the different pieces being held in place by outlet box covers through which they are run. Three No. 2 wires are installed in 1½-in. conduit from the main service located in the basement of the building to the roof where two cabinets are installed containing the necessary circuit blocks.

In order to demonstrate to the bank officials the effect of this system Mr. Burgard devised a clever method of illustrating it. An outline of the building was sketched on a piece of extra heavy paper. The lighting system was then drawn in and at the points where the lights were to be placed, holes were made approximately the size of the lights. On the back a piece of light yellow tissue paper was pasted. In this way by placing the drawing in front of a light stronger than the surrounding light, the proposed lighting effect on the building was clearly shown.

FIXING THE SELLING PRICE FOR SMALL MATERIAL PURCHASES.

Inability of Contractor to Give Definite Figure Causes Customers to Distrust Him.

There are a great many pieces of electrical construction material which can be used advantageously for other classes of works such as is usually done by the houseowner himself around the home. For example, conduit is often used for lawn fences where its rust-resisting qualities are very desirable. Locknuts, washers, screws, nuts, wire, etc., are other articles often desired and purchased from the neighborhood electrical contractor. While it is true that such sales are not sufficient to enable the contractor to realize any substantial profit from them, he can in this way render a service to the community which will improve his standing in it and at the same time often be the means of securing real business for him.

One of the most objectionable features in connection with such transactions, however, is the inability or timidity of the contractor to set a positive selling price for such material. Invariably he will state his price as "about so much," or "such a price to you," whether he is personally acquainted with the customer or not. This gives the customer the impression that the contractor does not know his business and leaves a doubt in his mind as to whether or not he has paid a fair price for the article. Nor does it gain the contractor the customer's friendship any more than if he had stated definitely the price of the article and suggested a further purchase.

As already stated the volume of this business is not great enough to warrant hiring a special salesman for such work or even to fix a price for every article in stock but it is much better to take a pencil and paper and figure out the price for every sale than to make a rough mental calculation and submit a vague figure. The contractor may also refer to the catalog or if he is a member of the National Association of Electrical Contractors and Dealers he may use his Universal Sales and Data book, which gives a resale price for material. The customer in the majority of cases realizes that such sales are out of the usual routine of the contractor's business and does not expect him to have the price already marked for the article, but he does expect that the contractor can get the price definitely and not guess at it.

Nor should he be afraid to give the price definitely including a sufficient margin to cover his overhead and profit. The cigar store dealer may be known to everyone by his first name, yet he sells everyone at a fixed price without endangering his business. Why then should the electrical contractor hesitate to state a definite price for such convenience purchases?

WIRING DATA FOR DIRECT AND ALTERNATING-CURRENT MOTORS.

The fourth edition of "Wiring Data for Direct and Alternating-Current Motors" has just been issued by the Oregon Insurance Rating Bureau, of Portland, Ore. This is a revised edition and has been compiled by F. D. Weber, chief electrical engineer of the Bureau. This 32-page booklet is a valuable collection of tables, formulas and other interesting information relative to the wiring of the more common types and sizes of motors. The following gives an idea of the principal contents of the book: Rules for load-factor or demand-factor allowance; feeder sizes for two or more motors; wiring tables for 115, 230 and 550-volt direct-current motors; specifications for motors operated on grounded railway circuits; intermittent-duty alternating-current motors; feeder sizes for alternating-current motors; wiring tables for single-phase, two-phase and three-phase of various voltages and types; stranded copper conductor data; copper busbar data; motor-wiring formulas for different types of current.

To persons or firms outside of the state of Oregon, this booklet will be sent for 30 cents on addressing the Oregon Insurance Rating Bureau, Box 745, Portland, Ore.

BOSTON ELECTRICAL CONTRACTORS FAVOR THE 44-HOUR WEEK.

At a meeting of the Electric Section of the Building Trades Employers' Association of Boston, held on July 1, it was decided as the sense of the meeting that a 44-hour week schedule be adopted. Representatives of 10 of the leading electrical contractors were present.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 464.—Transformer Design.—I am trying to build a transformer with 110-volt primary and 14 steps on the secondary varying by 7½ volts up to 105 volts, thus, 7½, 15, 22½, 30, etc. Each step must be capable of carrying 10 amperes. What size and amount of wire is necessary on the primary and secondary windings?—W. A. S., Augusta, Kans.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

No. 468.—Wiring Lights From a Bell-Ringing Transformer.—Is there any provision in the National Electrical Code against reducing 110 volts to a lower voltage by means of a bell-ringing toy transformer and then wiring some small lights from this? Is it all right to run this wiring in the same way as ordinary bell wiring? If this is permitted, what is the highest voltage and wattage permissible on such bell wiring?—S. T. E., Bridgeport, Conn.

No. 469.—Length of Motor Branch Line.—What limit, if any, is there to the length of a tap line from a No. 0000 feeder to an autostarter for a 2300-volt motor? The tap line is to be No. 6 or No. 8 lead-covered cable run in conduit?—A. S. N., Plymouth, Mass.

No. 470.—Pulling in Lead-Covered Cable.—I would like information in regard to pulling lead-covered cable into iron conduit. What kinds and sizes of grips are suitable for use in pulling No. 0000 triple-conductor, lead cable of 2-in. outer diameter into 2½-in. conduit? Through how long a run and around how many elbows is it safe to pull this? I should like similar information regarding other cable sizes down to ¾-in. in diameter.—A. S. N., Plymouth, Mass.

Answers.

No. 462.—Electric Welding of Rails.—Is there a definite dividing line between spot and arc welding as to where one would be used and not the other, or does their utility overlap to a certain extent? I refer especially to the welding of street-car rails, for which both methods seem to have been used. Which method is preferred for this work?—T. N., Toledo, Ohio.

[One answer to this question was published in the issue of June 21, 1919.—Editor.]

Answer B.—There is no definite dividing line and the method used depends a great deal on the local conditions. Where the power is limited and only a few joints are to be made the arc welding outfit is generally used. The spot welder offers the advantage of heavy contact pressure, thereby making a lower resistance bond. The spot welder requires considerable power for shorter periods and consequently requires large machinery.

The spot welder is usually employed on large jobs and the arc welder on small jobs, the method used depending merely on the quantity of work and the distance and transportation facilities to the job with the equipment.

Wherever possible the spot-welded joint is used. Cost runs about $4500 for the first 1000 welds and about $800 for each additional 1000 welds. This cost is about twice that of the bolted type of joint. The Board of Supervising Engineers, Chicago Traction, made many tests on various bonding methods and these tests are found in its annual reports.—H. E. W., Chicago, Ill.

No. 465.—Underground Conduit.—The writer is about to install 4000 ft. of 1½-in. conduit underground to carry a No. 6 lead-covered single-conductor cable supplying a potential of about 1100 volts on a series "White Way" lighting system. As this conduit will only be about 8 to 12 in. under the sidewalk, I have been advised by an engineer of authority on metallurgy that a black iron pipe would last as long on this installation as galvanized conduit and he suggests that I use plain iron pipe and give it a good coating of asphaltum. The suggestion appeals to me from the standpoint of cost, which would only be about half as much as galvanized conduit and the material could be handled in 20-ft. lengths. I would like to take advantage of this suggestion, if practical, but don't want the cost to mislead me on a good job. I would like to hear from some of the readers experienced in this subject before going ahead with this installation.—W. W., Ludlow, Ky.

Before installing iron pipe for an underground duct line, standard 3½-in stone or tile duct should be given careful consideration. Stone or tile duct placed under a sidewalk would require little concrete work, and is probably the least expensive and most lasting duct line that can be installed. Careful consideration should be given to the future requirements of a given territory before installing a duct line. It generally pays to install at least a 4-duct line, unless there is no possible need for future circuits.—W. H. K., Evanston, Ill.

No. 466.—Grounding Transformers and Secondaries.—Up to the present time the undersigned has always grounded the neutral of secondaries on transformer poles, together with grounding the transformer cases at this point and installing the lightning arresters on the next pole away from the transformers. It is now strongly recommended by leading engineers that the lightning arresters be installed as near as possible to the transformers, which doubtless means on the same pole, and the neutral grounds will now have to be made at another point. I am in favor of this change and appreciate its protective advantages, but would like to hear from readers as to best location for the neutral grounds and their ideas on grounding the transformer cases.—H. M., Cincinnati, Ohio.

Answer A.—Electrical engineers are not of one opinion as to whether the grounding of transformer cases does result in additional protection against lightning. This subject is very much like that of a few years ago of grounding the secondaries where there were two different schools, one of which was strongly for and the other equally strongly against grounding.

Theory dictates that grounding transformer cases should reduce the likeliness of lightning damaging the transformer winding. Experience also proves that the theory is correct. The reason why transformer cases are not grounded to a wider extent than they are is because of the danger to linemen, the disadvantage in this respect offsetting the benefit of better protection against lightning.

It is not of extreme importance that the lightning potential between transformer winding and the earth or ground be kept down to a comparatively low value. On the other hand, it is extremely important that the difference of potential between primary and secondary, and likewise between primary, secondary and case be kept down to a safe value. Connecting the lightning arrester between primary winding and case, and further, connecting the transformer case to ground, accomplishes this.

It has been suggested to go a little further, namely, connect the transformer secondary and case to the lightning arrester through a small air gap. The effect of doing this is to enable a potential of several hundred thousand volts to exist between transformer and

case, while at the same time the potential actually existing between transformer primary and secondary, and transformer windings and case, will be only a few thousand volts—perhaps eight or ten thousand—which a transformer subjected to the A. I. E. E. standard test could withstand.

Such an arrangement as explained above makes the protection of the transformer independent of the resistance of the ground resistance and eliminates the impedance of the ground wire between arrester and ground—a very great benefit where high-frequency discharges take place and the ground wire is long or of small cross-section. The actual benefit from grounding transformer cases will vary, and will, of course, be greatest in those localities where only high-resistance grounds can be obtained, and where long ground wires are employed.

The reason that the cases of distributing transformers are not grounded more generally than is the case, is chiefly for the reason that a grounded case creates a very real hazard for linemen working on the same pole with the grounded case. The hazard can be reduced by installing a link switch so as to disconnect the case from ground while men are working on the pole. This costs money, may be forgotten and adds a complication where conditions are already complicated enough.

As regards the location of lightning arresters, these should be installed upon the same pole as that on which are installed the transformers they are to protect. It has been shown conclusively by D. W. Roper in his papers before the A. I. E. E. and the N. E. L. A., that arresters are very much more effective in protecting when located beside the transformer than when even only one span away. The N. E. L. A. Handbook on Overhead Line Construction advocates installing the lightning arresters upon the same pole as the transformers they are to protect.

A transformer secondary should be grounded as near the transformer as possible. This means at the same pole. The lightning-arrester ground and the secondary ground wires should be kept separate and each should have its own "ground." Where a transformer case is grounded, the same conductor may be employed for the secondary. Secondary ground wires should be protected by wood covering up to about 7 ft. above ground at least.—B. M. S., Cicero, Ill.

Answer B.—For maximum protection lightning arresters should be installed on the transformer pole. The lightning-arrester ground and secondary ground should consist of two distinct grounds and should be on the transformer pole. In addition, the secondary should be grounded every 500 ft. The writer is not in favor of grounding transformer cases in the ordinary pole-type installation. A grounded case presents too large an area to be worked around safely. The linemen should be protected from arrester and secondary grounds by the use of wood molding.—W. H. K., Evanston, Ill.

BOOK REVIEWS.

"British Electrical Trades Directory and Handbook." Published by "The Electrician," 8 Bouverie Street, London, E. C. 4. Cloth; 1330 pages. 6½ by 9½ in. For sale by International Trade Press, Inc., Chicago. Price, $2.00.

The volume is prepared to supply information on all questions relative to the electrical industry that have a bearing on British affairs. The contents of the volume range from definitely technical to merely general matters so that it is valuable alike to the engineer, the contractor, and the dealer. The material in the volume, moreover, is gathered from all parts of the British realm and from such other countries as may be desirable to British engineers and contractors.

The volume is divided into two sections: namely, literary and directorial. The former section contains information about patents, designs, and trade-marks, domestic and foreign, about weights and measures, etc. The electric lighting acts and clauses regulating all phases of apparatus and practices occupy nearly 200 pages.

The directorial portion of the volume, which occupies nearly 900 pages, contains a classification of the electrical industry in Great Britain and its possessions. The classification of the industry in Britain is made alphabetically according to the name of individuals or companies and, again, according to the branch of industry. Classification of the industry in the colonies is made separately. The industry of the United States is not included in the volume. The volume, which is somewhat larger than the 1918 issue, will be of great value to the electrical industry not only in Great Britain and its colonies, but also to that in all other countries.

"Electricity and Magnetism for Engineers," by Harold Pender. Published by McGraw-Hill Book Co., Inc., New York City. Cloth; 200 pages (6 by 9 in.), 170 diagrams. For sale by International Trade Press, Inc., Chicago. Price, $2.00.

This is the second part of a treatise on Electricity and Magnetism for Engineers. Part I treats of Electric and magnetic Circuits, and the second part is devoted to Electrostatics and Alternating Currents. As the titles are not mutually exclusive, so we find that the treatment of alternating currents is not confined to Part II, but some phases of the subject are discussed in Part I.

While the treatment of electrostatics and alternating currents is theoretical, it is also from an engineering point of view, and the practical bearings of the principles are brought out by numerous problems and examples.

There are several interesting features of the text. The one that first impresses itself upon the attention of the reviewer is the scientific thoroughness of the discusions, and coupled with this is the care exercised in stating the limitaions of formulas. This last feature is especially valuable from a practical viewpoint. The statement of the limitations of formulas will save much confusion on the part of beginners, but it will do more than this. It will tend to develop in the student the power of discrimination and exactness.

Since the book is a continuation of Part I, the chapters are numbered consecutively throughout both volumes. The subdivisions of electricity and magneism treated in Vol. II are:

Electric Fields of Force, Electrostatic Capacity, Sine-wave Alternating Currents, Impedance and Admittance, Reactance and Susceptance, Effective Resistance and Effective Conductance, Polyphase Circuits, Symbolic Notation, and Non-sinusoidal Alternating Quantities.

The chapters on symbolic methods of solving alternating-current problems and on the analysis of alternating or non-sinusoidal waves will be found very useful in practice.

Any student who masters the principles explained in this text will have a most excellent foundation for the more technical studies of electrical engineering. The book should therefore be widely used by technical schools. C. M. JANSKY.

New Appliances

Mazda C-4 Lamp—Headlight Control Switch—New Cords —Berthold Washer—Willys Light—Marble-Card Machines

The White Mazda 50-Watt Lamp.

An important development in incandescent lamp manufacture is the "White Mazda" 50-watt lamp, or as it is also called the Mazda C-4 lamp. It was first briefly announced at the Atlantic City convention of the National Electric Light Association and further particulars have been made public in Bulletin No. 37 just issued by the Engineering Department of the National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio.

The new lamp is unique for several reasons. It has a milk-white smooth bulb which gives excellent diffusion of the light over its entire surface. It is of the gas-filled type, being the smallest lamp yet made of this type. It is a tipless lamp. The following facts are taken from the bulletin referred to:

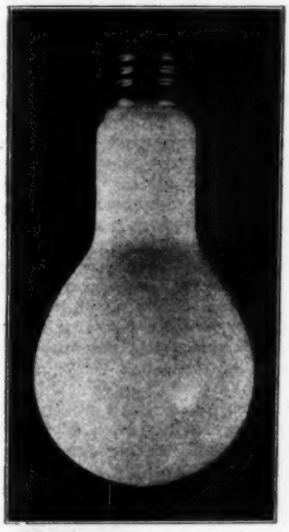
"The outstanding characteristic of this lamp is the pleasing softness of its light. The large volume of light which the small filament emits is diffused to the point where the bulb itself appears luminous. The brightness of the bulb is about 13 candles per sq. in. over the brightest square inch of area, which is, of course, far below that of the filament of a Mazda B lamp. The white Mazda lamp is made in the 50-watt size, and, notwithstanding the low brightness of the bulb, supplies more light than the 50-watt Mazda B lamp.

"It has been pointed out many times that glare (which, however defined, is ultimately light which hurts the eye) is to a considerable extent a matter of brightness contrast. The familiar illustration of automobile headlights, which glare at night but which are scarcely noticeable during the day, will be recalled. Because of the softness of its light, the white Mazda lamp can be used satisfactorily in locations where any other incandescent lamp unless frosted would be objectionably bright. Frosting the bulb has always proved an effective means of reducing the brightness of small incandescent lamps, but the practice has not been widely followed, largely because the frosted bulb collects dust and dirt more quickly than a clear bulb and is more difficult to clean. The bulb of the white Mazda lamp is smooth, and is as readily cleaned as a clear-glass bulb.

"There will, perhaps, be a tendency to use the white Mazda lamp without reflecting equipment because of the softness of its light. However, for most locations the bulb is still too bright to be used alone; moreover, it must be remembered that reducing glare is only one of the functions of a reflector. From the standpoint of effective distribution of the light generated, it is just as important that a good reflector be used with a white Mazda lamp as with any Mazda C lamp.

"Broadly, the field for the white Mazda lamp lies in the replacement of the smaller sizes of Mazda B lamps in existing reflector equipment. The effect produced by using white Mazda lamps in semi-indirect fixtures is particularly pleasing, for distinct shadows of the bowl edge and the bowl suspension, and all striations on the ceiling, are eliminated because of the large area from which the light comes. For the same reason, white Mazda lamps are also particularly desirable for portable lamps, where their use will eliminate the formation of grotesque, and frequently annoying shadows upon the walls or upon the pages of a book; fringe shadows, which are often very disagreeable, are eliminated.

In Table 1 are given the results of tests made to determine the effect of



White Mazda (or Mazda C-4) 50-Watt Lamp—Approximately One-Half Actual Size.

the diffusing bulb upon the output of lighting units. It will be noted that there is little difference in the absorption of any of the units tested when equipped respectively with Mazda B and with white Mazda lamps.

TABLE No. 1—DATA ON LIGHT OUTPUT.

Type of Unit.	Output in Per Cent of Bare-Lamp Output. Mazda B.	White Mazda.
Glass bowl, 6-in. diameter.	85.4	87.6
Glass bowl, 7-in. diameter.	84.8	86.1
Enclosing unit	77.5	76.4
Enameled-steel bowl	60.5	61.3

"With regard to the service which may be expected from white Mazda lamps, it may be said that laboratory tests indicate a satisfactory degree of ruggedness for home lighting, office lighting, and hotel and public building lighting, where these lamps will probably find their chief application. The low bulb brightness may result in white Mazda lamps, despite their higher wattage, being used to replace many smaller lamps used on extension cords for the inspection of machined interiors and similar places difficult to light with any general lighting system, and only trials under service conditions can establish what degree of rough handling in drop-cord service the white Mazda lamp will withstand.

"The white Mazda 50-watt lamp is made in the pear-shaped bulb, which is the shape used in Mazda C lamps. It will be noted from the illustration that the bulb is tipless. The lamp has about the same maximum dimensions as the 40 and 50-watt Mazda B lamps. No difficulty should be experienced in replacing Mazda B lamps in existing reflectors or shades."

Additional technical data are as follows: The lamps are made for voltages from 110 to 125; their lumen rating is 490, giving an efficiency of 9.8 lumens per watt. The bulb diameter is 2½ in. and the maximum over-all length is 5⅛ in. The base is medium screw size. The rated average life is 1000 hours; 50 is the standard package quantity.

The lamps are made by National Lamp Works of General Electric Co., Cleveland, Ohio; Edison Lamp Works of General Electric Co., Harrison, N. J.; and Westinghouse Lamp Co., New York City.

Ingenious New Locomotive-Headlight Switch Now Being Made.

High-speed railroad operation in the open country at night requires a very powerful locomotive headlight to insure safety. When nearing a train approaching on an adjoining track, a brilliant headlight confuses the other engineman, however. Also, when approaching signals the brilliant light of the headlight may cause confusion or inability to read the signal correctly.

Within cities a very bright headlight also causes blinding confusion and dangerous annoyance to pedestrians, teamsters and automobilists.

These conditions make it desirable to control the brightness of the headlight to a dim value when desired.

A new locomotive headlight switch has recently made its appearance. It has a number of features that will quickly appeal not only to the master mechanic but to the locomotive engineer.

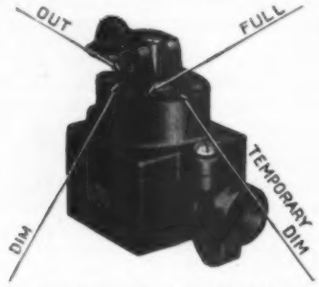
This headlight switch is a complete, self-contained, dust-tight switch that will effectively take the place of a double-throw switch for dim and full light, and a momentary-contact switch for temporary dim light.

With an easy push the handle goes from "Off" to "Dim" and another slight

push sends it to "Full." Going into "Dim" before going into "Full" gives the filament a chance to heat before coming to full glow, which means a longer life for lamps.

While passing another locomotive or for picking up signals, it is not necessary to bring the switch back to the "Permanent Dim" position. The engineer merely pushes the handle from "Full" to "Temporary Dim," holding it until he has passed the other train or the signals, when he releases the handle and the switch automatically snaps back to "Full."

If going through a yard or a city where the headlight must be dim, a



Switch for Convenient Control of Locomotive Headlight Through Several Degrees of Intensity.

slight lift of the handle brings the switch back to the "Permanent Dim" position.

This handy little switch can be mounted at any place in the cab that is suitable. Its mechanism cannot get out of order. The internal spring and the stops on the cover insure proper location of the switch at the position desired and makes it impossible for the switch to stop between positions. This switch is a new product of the Crouse-Hinds Co., Syracuse, N. Y.

Belden New "Hard Usage" Portable Cord.

The Belden Manufacturing Co., Western avenue and Twenty-third street, Chicago, Ill., has developed a special type of portable cord, "Underwriters' PWp.," which has been exceedingly well received by the trade. This cord, while resembling the ordinary weatherproofed portable, has certain differences in construction that make it much more durable. Instead of the usual 1/64-in. wall of 10% rubber over the two conductors, there is a 1/32-in. wall of 20% (Beldenite) rubber. Then, in place of the ordinary soft cotton braid, there is a heavy twine used for the outside cover. The result is a cord which is exceptionally strong and which will stand exceedingly hard usage.

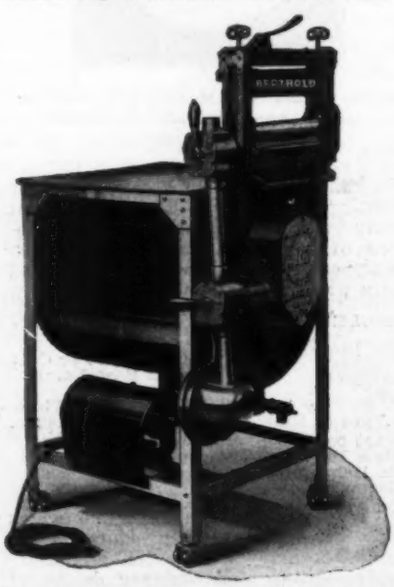
It has been found that when this cord is used for portable lamps, tools, etc., in garages, machine shops, locomotive repair shops and such places where the ordinary cord is subjected to extraordinary wear, it has a life which compares very favorably with armored cable and has the advantage of being much more flexible.

Berthold Electric Washing Machine.

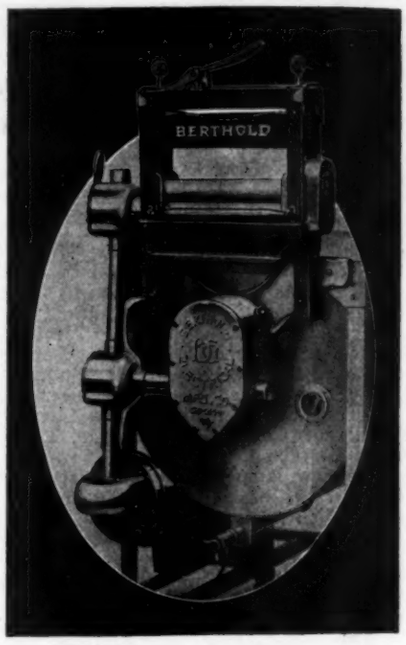
The increasing demand for electric washing machines of the last few years is stimulating the production of new devices of this kind, and among these one of special interest is the washer recently placed on the market by the Berthold Electrical Manufacturing Co., 127 South Green street, Chicago, Ill. This machine has been developed by E. E. and G. W. Berthold, who have been connected with the Electric Apparatus Co. for about 11 years and their new design incorporates their experience with various types of appliances.

The new Berthold washer was designed with three principal ideas in mind. These were: Ruggedness and durability of construction, safety in operation, and efficiency in service. The accompanying illustration shows that the machine consists almost exclusively of metal, the only exception being a few parts of the wringer. The framework consists of angle irons well braced and secured together. The mechanism (including shafting, gears and other moving parts) is entirely inclosed in a one-piece casting. This is done for a number of reasons. First, it prevents these parts from getting out of order or alinement; it safeguards the operator or anyone else from having her or his clothing entangled in exposed gears or other moving machinery; finally it permits the gears, bearings and other running parts to be operated in oil just like the transmission of an automobile. This latter provision dispenses with the need for grease or oil cups and positively prevents any oil from oozing out of bearings or other places so as to stain the clothes being washed or the dress of the operator. It also provides the most perfect lubrication so as to insure very efficient operation and, therefore, low power consumption. The matter of safety, referred to above, has been given special consideration because exposed moving machinery around a washer has been found dangerous not only to the operator but to children who frequently are playing about the laundry while their mother is taking care of her washing. The complete inclosure of the machinery also insures very quiet running.

The machine operates on the reversing cylinder principle. The cylinder makes 5½ revolutions and then automatically reverses, repeating this cycle without attention. The capacity of the cylinder is eight large sheets or their equivalent. The cylinder is made in two types, either of solid copper or of



The Berthold Electric Washer with All Gears, Shafts and Other Moving Parts Enclosed in a One-Piece Casting.



Enlarged View of Berthold Washer Showing the Large One-Piece Enclosing Casting.

galvanized steel. Simplicity of control is secured by providing only two operating levers, one of which starts and stops the washing cylinder, and the other starts and stops the wringer in either direction. The washer and wringer may be operated independently or together at the same time. The wringer is of the highest quality obtainable and is provided with a safety release to prevent damage to buttons or other delicate parts of the clothes in case a batch should become choked in the rolls. A high-grade motor is used; it is protected from splashing water as shown. The machine can be easily moved about since it is provided with the easy running casters. A sheet-metal top permits using the top as a table. Every detail in its construction and assembly is taken care of to insure perfect operation and freedom from trouble.

John N. Willys to Market New Electric Light and Power Plant.

A modern electric lighting and power plant for farms, rural schools, churches, suburban homes, yachts, etc., is to be manufactured by one of the John N. Willys companies, the Electric Auto-Lite Corporation, of Toledo, Ohio. The new outfit will be known as "Willys Light." It will be marketed by the Willys Light Division of the Electric Auto-Light Corp. through distributors and dealers. The formation of the sales organization is now under way; it will extend throughout the United States and eventually throughout the world.

The new plant is claimed to be the most complete that has yet been placed on the market. It is operated by a

Willys-Knight sleeve-valve engine which is known for its simplicity of operation and its quietness. The engine has been developed to such an extent that it requires practically no attention and is so simple that a child can operate it, according to those who have observed it.

The complete plant consists of a Willys-Knight engine, a direct-connected generator, a simple control box and a storage battery. The engine burns kerosene at approximately one-half the cost of gasoline. It is air-cooled, self-cranking, self-running, and self-stopping. The control is semi-automatic.

Noisy poppet valves are eliminated in the Willys-Knight engine. In their place are two cylindrical sleeves, one within the other, which glide silently up and down between the piston and the cylinder wall. The long ports in these sleeves register with each other and with the ports in the cylinder wall at the proper intervals, forming large and direct passages for the intake and exhaust gases. This engine is said to improve with use; carbon, instead of decreasing its efficiency, increases it.

The Willys Light generator is shunt-wound and designed for 32 volts. Its capacity is 750 watts. The armature of the generator, the engine flywheel and crankshaft are constructed in practically one piece, thus eliminating separate generator bearings and reducing friction.

The battery consists of 16 lead type cells with 9 plates to the cell. These are enclosed in sealed glass jars. They have a capacity of 160 ampere-hours.

The quality and dependability of the new equipment is assured by the fact that John N. Willys would not have permitted it to take his name until the outfit had been proved out thoroughly. With the Electric Auto-Lite Corp., a company long engaged in the manufacture of electric lighting and starting systems for automobiles, producing it, there is assurance as to the high standards of manufacture that will enter into its construction and of service in its distribution.

The new lighting outfit is adapted to a large number of uses. In addition to its general utility on the farm, it is available for isolated cotton gins, lumber and construction camps, oil and gas-pumping stations, mines, outlying stores, garages, dairies, telephone exchanges in smaller towns, and railroad stations. It also may be utilized for remotely located hospitals, fishing and hunting clubs, country homes, for street, store and home lighting in very small towns, for small theaters, military camps, and in summer resorts and cottages.

New Line of Commutating-Pole Motors and Generators.

Direct-current generators and motors have been manufactured over 35 years, but improvements in construction are still being made as is shown in a new line of these machines developed and manufactured by the Marble-Card Electric Co., Gladstone, Mich. These motors and generators are designed to incorporate some 26 years of fruitful experience in designing direct-current machines by John F. Card, during which time over 40,000 machines have been built after his designs. Every detail of the new line of these motors and generators has been carefully studied and the final features selected to combine in the complete design the highest standards of construction and operation. The machines are liberally proportioned and conservatively rated, and are therefore especially adapted for exacting service.

All machines are of the commutating-pole type with as many commutating as main poles; these insure perfect commutation at all times and eliminate the need for shifting the brush position. The field frames are made of high-grade cast steel in one piece, including the feet. All poles are securely attached with two lag screws; the main poles are laminated and assembled under hydraulic pressure. All bearings in standard machines are of the best ball-bearing type of generous size to withstand all possible strains; these ball bearings assure low losses and therefore high efficiency and also permit a shorter shaft length. The bearing brackets are designed so that the machines may be mounted on floor or ceiling without any change whatever. If mounted on a side wall or column it is necessary to rotate the outer bearing closures only to bring the drain plugs into the vertical plane. The sliding base is of heavy construction and has a three-point bearing and improved belt-tightening device within the base.

The brush holders are of very simple and effective design, having only two moving parts and no spring adjustment, the tension of the spring being set at the factory to the correct value. The commutators are of rolled copper with the mica undercut; they are of large size. All armature coils are form-wound, dipped and baked. Field coils are wound on collapsible forms, covered with many layers of oiled muslin, taped, dipped and baked, and finally varnished. Commutating-pole coils are wound directly on the poles after these are first well insulated.

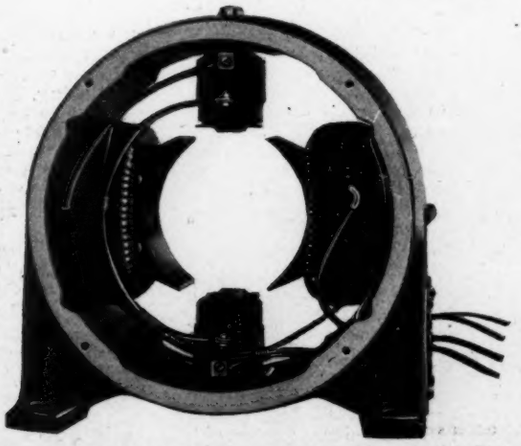
These machines are made in the two-pole type in the smaller sizes (7.5 hp. and smaller) and of the four-pole type for 7.5 hp. and larger sizes. The standard speeds are 575, 850, 1150 and 1700 r. p. m. Standard motors are made with either shunt or compound field windings. All terminals are brought out to the terminal board so that it is very easy to change motor direction. All the machines are especially well ventilated and are quiet in operation. They are well suited for a variety of purposes and the motors have been found especially adapted for electric freight and passenger elevators. The generators have been found exceptionally well suited for low-voltage farm lighting plants and motion-picture service.

Portable Suspension Cord for Gas-Filled Lamps.

The Belden Manufacturing Co., Chicago, Ill., has developed and placed on the market a cord especially adapted for pendent lighting units using gas-filled lamps. This cord, which has been approved by the National Board of Fire Underwriters, is made in both the types "P" and "PS" portable, and consists of the ordinary conductor, rubber-covered, and then covered with a heavy braiding or serving of asbestos. The remainder of the construction, that is, the rubber outer wall and braid over-all, is the same as in the ordinary portable.

This type of construction has been developed as a result of the insistent demand of the trade that the portable cord for pendent purposes be so manufactured as to withstand the very high temperature of the commercial gas-filled lamps, and for this purpose it has proved itself to be excellently adapted.

Type M. C. Direct-Current Machine, Showing Commutator End.



View of Field Frame, Showing Arrangement of Main and Commutating Poles.

Trade Activities

Eureka Vacuum Cleaner Erects Large Modern Factory—C. T. Coe Company Takes Over Hafer Interests—Literature

Edison Electric Appliance Co., Hotpoint Division, Chicago, sustained a heavy loss when fire practically destroyed the storage house at 2214-30 Ogden avenue on Sunday, July 6. W. H. Casper, superintendent, places the loss at $75,000.

The Edison Storage Battery Co. announces the removal of its district office in Pittsburgh, Pa., to Room 431 Union Arcade building. The removal has been made necessary by the tremendous increase in the volume of business handled through this office. The new location provides better facilities and more commodious quarters.

P. W. Miller Co., 735 Andrus building, Minneapolis, Minn., has entered the field as an electrical jobber in 32-volt accessories. The company has just obtained a contract from the Electric Auto-Lite Corp., Toledo, Ohio, for the Willys farm lighting plants for the state of Minnesota, part of North Dakota, Wisconsin and Montana, and anticipates a large volume of business in this territory.

Jeannin Electric Co., Columbus, Ohio, has entered the electrical field, having recently been incorporated with an authorized capital of $150,000 to engage in the manufacture of electric motors. C. H. Clement, formerly with the Bock Bearing Co., is president and treasurer of the concern; H. W. Jeannin, vice-president, and Morton C. Seeley, secretary. The factory will be located at 110 11th street and will have an estimated output of 100 small motors monthly.

The Wallace Barnes Co., Bristol, Conn., has issued Booklet No. 7 descriptive of "Barnes-made" springs, screw machine products, cold rolled steel and wire, washers, stampings, etc. The booklet is well illustrated and contains a number of diagrams and tables showing decimal equivalents of wire, gauges, weight of cold drawn steel, weight of cold rolled strip steel and weight of wire; also specifications to be used in ordering compression and extension wire springs, and table of capacities of compression and extension wire springs.

Contra-Pole Electric Co., 1227 Prospect place, Brooklyn, N. Y., recently incorporated with a capital stock of $100,000, is manufacturing electro-therapeutic apparatus. Mortimer E. Freid, formerly affiliated with the purchasing department of the Signal Corps of the Army, is president of the company; Julien de Beaumont, consulting electrical engineer, first vice-president; Julius Heinecke, general manager of Liebig Extract Co., second vice-president; Samuel T. Siegel, attorney, 165 Broadway, New York, secretary.

The Aberthaw Construction Co., Boston, Mass., has opened a permanent office in Atlanta, Ga., which will be under the direction of N. McL. Sage.

The Electric Furnace Construction Co., Finance building, Philadedphia, reports the receipt of an order for a one-ton Greaves-Etchells electric furnace from the Sullivan Machinery Co., Claremont, N. H.; also an order for a furnace for the manufacture of coinage bronze from the Imperial Japanese mint, Osaka.

F. I. Hutchinson, mechanical engineer, founder of the Heating & Power Equipment Co., Milwaukee, Wis., has severed his connection with the company to engage in business for himself. He has opened offices at 1226 First National Bank building, Milwaukee, as a consulting and designing engineer of heating and power plants, specializing in central-station installations.

J. H. Honig, Antofagasta, Chile, S. A., announces the opening of an office at Latorre 446-448, which will give representation to American manufacturers who desire a connection in northern Chile. Mr. Honig has been engaged in this line of business for many years and until recently was manager of the Chile Trading Co., of Antofagasta. He will be pleased to hear from any manufacturers desiring representation in the territory mentioned.

Elvin Mechanical Stoker Co., 30 Church street, New York, has issued an illustrated folder describing the Elvin mechanical stoker for use on locomotives. Several advantages of the stoker are that its operations are wholly mechanical, that it regulates automatically the amount and distribution of the coal, and that it prevents the entrance of cold air into the fire box. An installation of the stoker on an Erie locomotive shows that the economy of the mechanical stoker is as great as if not greater than that of hand firing.

C. T. Coe Co., Chambersburg, Pa., engineer and combustion expert, owing to the greatly increased demand for the Coe grate and Coe turbine blower, has again found it necessary to extend its manufacturing facilities. The company has, therefore, purchased the plant, patents and equipment of the Hafer Foundry & Machine Co., Chambersburg, Pa., which since 1906 has been engaged in the manufacture of the Hafer double-shift rocking grate and Little Giant soot blower for boiler tubes. The plant has a foundry with a 12-ton daily capacity, brass foundry, machine shop, pattern shop, blacksmith shop, all of which has been added to the equipment of the Coe company, resulting in a more complete organization, better able than ever to supply the needs of the trade. The combined patterns of the two plants include all standard grates, arch plates, etc., so that the company is now prepared to manufacture a most complete line of boiler room equipment. The Coe organization specializes in everything that pertains to combustion and its competent staff of engineers is ready to solve problems relating to this important subject.

Central Electric Co., 316-326 South Wells street, Chicago, is sending out a new combined price list and catalog of new material designated as No. 39-A. Some 80 pages are devoted to a listing of net prices and discounts applicable to general catalog No. 39. The remaining pages carry a list of devices either new or redesigned, consisting of marine lighting and signaling appartus, industrial signals, receptacles and plugs, transformer and junction cutouts, switches, sockets, switch plates, lighting units, lamps, transformers, etc.

Acme Lighting Fixture Co. has taken over the plant of the Acme Gas & Electric Co., Inc., and will continue operations at 132-136 West 14th street, New York. The former company manufactures a complete line of electric and combination lighting fixtures, lamps and accessories, and has added to its staff competent designers of lighting fixtures in order to furnish special as well as staple designs of lighting fixtures and accessories. The company has greatly increased its facilities and is now in a position to meet the requirements of the trade. The present plant provides facilities for the production of designs of elaborate decoration, durable construction and lasting finish, embodying the newest ideas in interior and commercial decorative schemes.

American Electric Fusion Co., Warren, Ohio, is the name of a recently organized concern with an authorized capital of $25,000 to manufacture electrical apparatus for heating, melting and fusing. The company has acquired a two-story building which will be used as its plant. For the present the company will devote its attention to the production of a new type of an alternating current arc welder, which will be built in sectional form, the lower section to contain equipment for transforming standard voltages, 440, 220 or other commercial circuits, down to 60 volts. The upper section will contain the stabilizing and regulating apparatus. Fred P. McBerty, president of the Federal Machine & Welder Co., is president of the new organization; E. J. Henke, vice-president, and Z. A. McBerty, secretary and treasurer.

Roller-Smith Co., 223 Broadway, New York, has issued an illustrated bulletin (No. 140), describing a new device known as the "Handy" auto type volt-ammeter. This device has six ranges and provides a means of quickly and accurately making all the different tests which are involved in electric lighting and starting systems of automobiles. The entire outfit is simple, sturdy, compact, light and built for the hardest kind of service. "Handy" instruments are also furnished in a complete line of ammeters, milli-ammeters, voltmeters, milli-voltmeters and volt-ammeters.

The Central Station Steam Co., Detroit, Mich., announces the opening of a branch office at 902 First National Bank building, Chicago, with W. K. Abernethy, formerly manager of the Minneapolis office, in charge. All business in Illinois, Iowa, Nebraska, Missouri, Indiana and Ohio will be handled from the Chicago branch.

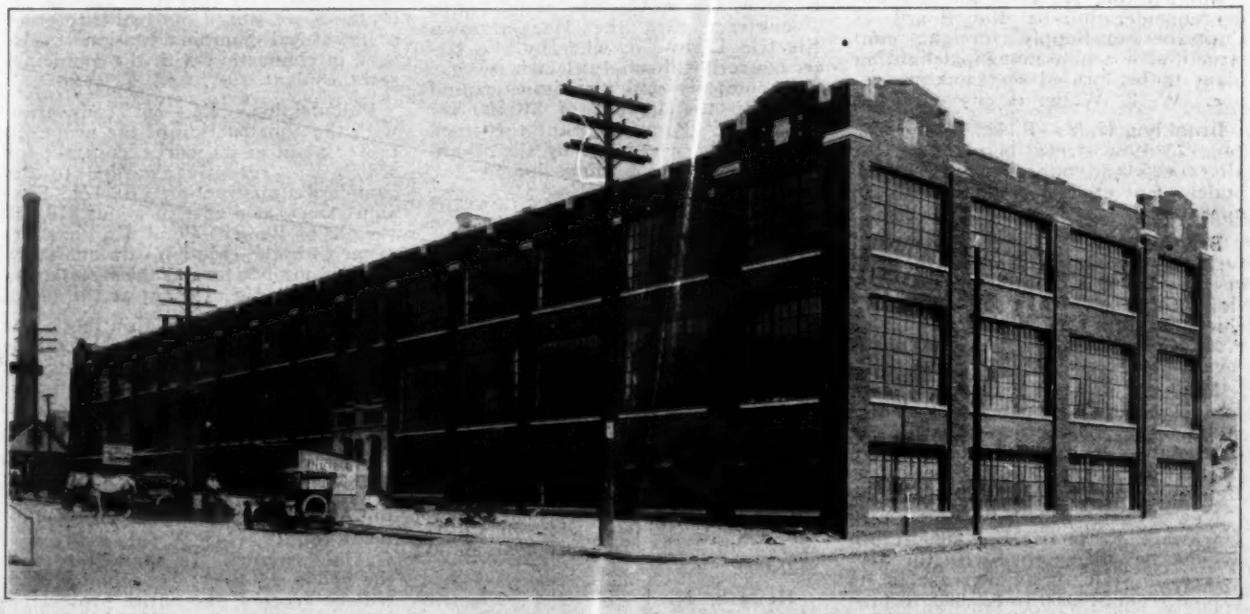
The Wellman-Seaver-Morgan Co., Cleveland, Ohio, has prepared Bulletin 22, which contains valuable engineering charts on shafts. The bulletin is devoted to three large charts giving the relations in any shaft between power, shaft diameter, torsional stress and speed, and contains several examples showing the method of using the charts. By means of these charts it is possible to instantly solve any one of four problems: (1) Given the power, speed and allowable torsional stress, to find the shaft diameter; (2) given the shaft diameter, power and speed, to find the torsional stress; (3) given the power, torsional stress and diameter, to find the speed; (4) given the speed, torsional stress and diameter, to find the power. These charts have been prepared by one of the company's engineers. Copies of the publication will be sent to all engineers and draftsmen free of charge upon request.

The Thistle Manufacturing Co. of Chicago, manufacturer of the "Up 2 Date" home electric washer, recently moved into its new factory, located on Armitage avenue, between Major and Mango avenues. The constantly increasing popularity and unusual demand for this washer made it necessary for the company to seek larger quarters, but as it is now able to produce twice the number of machines turned out heretofore, it will probably be able to keep up with the demand. The new factory consists of two floors of a large building, giving the company more than twice its former floor space. The building faces the main line of the Chicago, Milwaukee & St. Paul railroad at the Galewood yards, at which point are located the switch yards of the railway company. From this point all loaded and unloaded cars running over the Milwaukee line are handled. This location gives the Thistle company excellent shipping facilities. In addition it has equipped the new factory with the most modern machinery, giving it every facility for quick and efficient work.

Eureka Vacuum Cleaner Co., Detroit, Mich., has erected a new plant which it claims is the largest exclusive vacuum cleaner factory in the world. The building is a three-story structure and covers an area of over 19,000 sq. ft. Over 60,000 ft. of floor space is provided and the plant is equipped with a tremendous amount of up-to-date machinery which will make possible the production of 1000 electric cleaners per day. Since the war the influx of orders for the Eureka cleaner has been so great as to render the company's facilities entirely inadequate to meet the demand, and at the present writing orders for 12,000 machines remain unfilled. The building of this large factory is indicative of the optimistic view the Eureka company has of the future, and also signifies the success and stability of the vacuum cleaner industry as well as the remarkable success which has attended the Eureka cleaner. The company is also erecting in the heart of Detroit a five-story office building which will be used as the general offices of the Eureka Vacuum Cleaner Co. exclusively. It is modern in every respect and affords ample space to handle a business which is rapidly expanding. The company is about to launch the largest national publicity campaign in its history to be of distinct aid to its many distributors throughout the country.

Fort Wayne Engineering & Manufacturing Co. has prepared for the dealers' bulletin file a catalog of the Paul water systems, bringing together under one cover a number of bulletins which have been issued from time to time. It contains descriptions, diagrams and list prices of the popular combinations of pumps and systems to meet most requirements within their limits. The company has also issued Bulletin 5005, superseding Bulletin 4096, describing Paul electric pumps and water systems using 32-volt direct current. Installation examples of these systems for the farm and country home are given as well as detailed descriptions of the various pumps and systems manufactured by this company.

Mercury Manufacturing Co., 4179 South Halsted street, Chicago, has issued a new publication entitled "The Trackless Train" treating of the Mercury method of internal transportation, which will attract widespread attention and prove very interesting to users and prospective users of industrial tractors. It discusses the development, use, construction and function, economy and flexibility of this system of industrial haulage and sets forth 15 pertinent reasons why the "trackless train" should be adopted. The bulletin is replete with illustrations of typical installations and the economy affected by the Mercury tractor is manifested by its representation in practically every industry. This method of internal transportation is based upon the sound principle that transportation efficiency requires the handling of material with the smallest possible number of men and the smallest possible number of power units. It is adaptable to every type of industry, and practically to every haulage problem within each. The advantages of this method of industrial haulage may be briefly summarized as follows: Installation economy, operating economy, flexibility, maximum operating efficiency, ease of operation and safety.



New Factory of the Eureka Vacuum Cleaner Co., Detroit, Mich.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Portland, Me.—Fire recently damaged the building of the Cumberland County Light & Power Co. It is understood that the company is planning for immediate repairs.

Rutland, Vt.—Rutland Railway, Light & Power Co. has recently been awarded a contract by the Wallingford Manufacturing Co., Wallingford, for furnishing additional power to the amount of about 100 hp. for the operation of a new saw and planing mill at its works.

Springfield, Vt.—Colonial Power & Light Co. is making rapid progress on the construction of the new electric substation, and it is expected that the work will be completed at an early date.

Quincy, Mass.—Fire recently destroyed the coaling station at the plant of the Quincy Electric Light & Power Co., with loss estimated at $15,000.

Hartford, Conn.—Case & Marshall, Inc., has awarded a contract to the J. H. Grozier Co., 721 Main street, for the construction of a new boiler plant at its works in the Burnside section. The structure is estimated to cost $10,000.

Binghamton, N. Y.—In connection with the installation of large quantities of electrical equipment at the new plant of the Achilles Rubber & Tire Co., work is now under way on the installation of a 150-kw. motor generator set. Power for operation will be furnished by the Binghamton Light, Heat & Power Co.

Binghamton, N. Y.—Plans are under consideration by the Board of Contract and Supply for the construction of a new municipal lighting plant to be located on Conklin avenue. W. E. Weller is city engineer.

Brooklyn, N. Y.—R. H. Comey Co., Inc., 73 19th street, is planning for alterations and improvements in the boiler plant at its works, to facilitate operations.

Brooklyn, N, Y.—Kayenn Manufacturing Co., manufacturer of electrical specialities, has completed negotiations for the leasing of the entire third floor of the building at 291-3 Adams street, for a new establishment.

Manhasset, L. I., N. Y.—Town Board, North Hempstead, is understood to be considering plans for the extension of its street lighting system on Station Road, at Great Neck Station to connect at Kensington.

New York, N. Y.—Long Acre Hardware & Electric Co., 806 Eighth avenue, has filed notice with the Secretary of State of an increase in its capital from $10.000 to $20,000, to provide for general business expansion.

New York, N. Y.—New York Edison Co., Irving Place and 15th street, has recently been awarded a contract for furnishing electric energy for the operation of the plant of the Auto-Strop Safety Razor Co., 656 First avenue. The works require 500 lamps for illumination, and 300 hp. in motors for manufacturing, as well as power for an electrically heated furnace for tempering steel blades. The company has also received a contract for furnishing power to the Union Trust building, 80 Broadway, and the Electrical Exchange, 136 Liberty street, having lighting installations of 2000 and 1000 lights, respectively.

New York, N. Y.—Belzo Electric Motor Co. has filed notice with the Secretary of State of a change in name to the Zobell Electric Motor Co.

New York, N. Y.—Alpha Electric Co., Inc., 116 West 29th street, has leased property at 151-55 West 30th street, aggregating about 22,500 sq. ft. for a new plant.

New York, N. Y.—Manhattan Railway Co. has had plans prepared for alterations and improvements in its one-story repair shop at Lexington avenue and 98th street. The work is estimated to cost about $50,000.

Syracuse, N. Y.—W. S. Hoffman, 329 Tuckel street, is having plans prepared for the construction of a new one-story foundry and power plant, about 50x200 ft., the entire work being estimated to cost $50,000. Contract for construction has been awarded to Dawson Brothers, Union building.

Califon, N. J.—Califon Electric Light & Power Co. has entered into a contract with the Hackettstown Electric Light Co. whereby the latter concern will supply electric service. The company will also issue capital stock to the amount of $10,000 for expansion. Permission for the stock issue has been granted by the Board of Public Utility Commissioners.

Dover, N. J.—New Jersey Power & Light Co. is making rapid progress on the installation of a new pumping station in the local plant. It is understood the station will be utilized for condensing purposes during dry seasons.

East Orange, N. J.—General Electric Co., Harrison, has filed plans for the construction of a two-story brick addition to its works on North 18th street, to cost about $40,000.

Jersey City, N. J.—Eastern States Refrigerating Co., 147 16th street, has filed plans for the construction of a seven-story concrete addition to its works on 15th street, to cost about $125,000.

Newark, N. J.—M. & L. Electric Co. has filed notice of organization to operate in a general electrical contracting capacity at 470 Warren street. Raymond Miller, 263 Bloomfield avenue, Verona, and Carl M. Lindheimer, 712 Ocean avenue, Jersey City, head the company.

Newark, N. J.—Weston Electrical Instrumental Co., 4 Weston avenue, has had plans prepared for the erection of a new addition to its plant. The structure is estimated to cost $7500.

Newark, N. J.—Terminal Electric Co. has filed notice of organization to operate a general electrical contracting establishment at 94 New street. Robert and M. M. Goldberg, 301 Belmont avenue, head the company.

Trenton, N. J.—Considerable electrical equipment of various kinds will be required in connection with the construction of the proposed hospital buildings to be erected by the state, contracts for which were awarded to the Standard Construction Co., Sansom street, Philadelphia, Pa., at a cost of about $300,000.

Trenton, N. J.—Trenton & Mercer County Traction Corp. has commenced work on the extension of its traction system from Bridge street to the municipal dock. E. J. Peartree is general manager.

Trenton, N. J.—A building permit has been taken out by the Hutchinson Storage Battery Co., Warren street, for the construction of new additions to its plant, to provide for increased capacity. The structures will be one and two stories, brick and steel, and are estimated to cost $16,500.

Westmont, N. J.—Township Committee has been granted permission by the State Board of Health to erect a new local pumping station, to be used in connection with the municipal sewage plant.

Philadelphia, Pa.—In connection with the construction of the proposed power plant at its works, contract for which was recently awarded to the Standard Construction Co., 1713 Sansom street, at a cost of about $10,000, the Niles-Bement-Pond Co. has arranged for the erection of a one-story brick pump house, and the installation of new boiler equipment at the plant.

Philadelphia, Pa.—Contract has been awarded by the Suspass Leather Co., Ninth and Westmoreland streets, for the construction of a new boiler plant at its works, estimated to cost $6000.

Philadelphia, Pa.—Plans have been prepared by the Griffon Co., Adams avenue and Wingohocking street, for the erection of a new three-story plant, about 4445 ft., at Unity and Oakland streets. In connection with the proposed structure, a boiler plant will be erected, the entire project being estimated to cost $104,000.

Pittsburgh, Pa.—Atlantic Refining Co. has filed plans for the erection of a one-story brick and concrete boiler plant to be located on Butler street, near 57th street, estimated to cost $25,000.

Elkton, Md.—Atlas Powder Co., Wilmington, Del., has disposed of its power plant at Perry Point to new interests. The company will be incorporated with extensive operating capital, and will operate the plant for local service. Electric energy will be furnished to Perryville, Port Deposit and Havre de Grace, with a system of distributing lines through this district. The new company is also planning for the erection of an ice manufacturing plant and mechanical laundry works, both to be electrically operated.

Seat Pleasant, Md.—The council is preparing to establish municipal lights. Address Severing Grobstad.

Clifton Forge, Va.—Notice has been filed with the Secretary of State by the Western Virginia Power Co. of an increase in its capital from $1,000,000 to $1,250,000, to provide for general expansion. W. G. Matthews is president; and A. C. Ford is secretary.

Bowman, Ga.—Bonds have been voted for issuance of municipal bonds for establishing an electric light plant.

Springfield, Ga.—The city contemplates the installation of an electric light plant. Address the mayor.

Unadilla, Ga.—The city will install an electric light plant.

Miami, Fla.—Miami Beach Electric Co., Carl G. Fisher and associates, was voted a franchise for operating an electric railway and light and power plants in Miami Beach.

NORTH CENTRAL STATES.

Canton, Ohio.—George Eastman, 401 Daily News building, has prepared plans and will let contracts for a $75,000 hotel to be erected here. The specifications include electric machinery.

Cincinnati, Ohio.—An ordinance has passed the council authorizing a bond issue of $22,000 to repair the city hall and to make the necessary changes in the wiring system to permit the lighting of the building by the Union Gas & Electric Co. Petitions were filed with the council to extend the boulevard lighting system on Race street from 12th to McMicken avenue and on Colerain avenue from Central to Millcreek bridge.

Mansfield, Ohio.—Mansfield Sheet & Tin Plate Co. will erect a $1,000,000 addition to its steel plant. When the new plant is completed the company will have a complete unit in the steel industry, permitting it to take ore through its several processes and turn out the finished plate.

Columbus, Ind.—City will vote Aug. 7 on the question of a $60,000 bond issue for the erection of a gymnasium.

Indianapolis, Ind.—Architect W. L. Jungclaus, 822 Massachusetts avenue, has prepared plans for a $10,000 power house to be erected by the G. & J. Tire Co. The building will be of brick construction, steam heated, plumbing, electric lighting.

DATES AHEAD.

National Council of Lighting Fixture Manufacturers. Midsummer convention, Cleveland, Ohio, Aug. 5 and 6. Secretary-treasurer, Charles H. Hofrichter, 8410 Lake avenue, Cleveland, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 19-21. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual Convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Logansport, Ind.—A new turbo-generator with a capacity of 200,000 voltage and weighing 75,000 lb., for use in the local electric light plant, has been installed at a cost of $25,000.

Chicago, Ill.—Grip Nut Co. has acquired a tract of about 250,000 sq. ft., on which it proposes to erect a large new plant. It will be one of the most modern in the country, will have traveling cranes extending the full length of the building and over the switch tracks. It is stated the building and ground will represent an investment of about $500,000.

DeKalb, Ill.—DeKalb-Sycamore Electric Co. is erecting cooling tower 75 ft. in height.

Urbana, Ill.—Board of local improvements has ordered the installation of 60 ornamental lamp standards on West Green street, at a cost of $6300. The board is also considering the installation of similar standards over the entire southwestern part of the city, adjacent to the University of Illinois. Address J. E. Smith, mayor and president of the board.

Villa Grove, Ill.—The failure of the Central Illinois Public Service Co. to furnish power several days the past weeks has started a movement to establish municipal lights. Address village clerk.

Lansing, Mich.—Architect O. E. Eckhart, City Hall, has prepared plans for extension to be made to the electric light plant. $300,000 will be expended, specifications including extension to electric light plant, steam heating, plumbing, power plant, electrical equipment. Contracts will be let by city clerk.

Black River Falls, Wis.—Architects Mead & Seastone have prepared plans for power plant to be erected by the city. Estimated cost $25,000. The power plant will be erected and engine dynamos, electric machinery purchased.

Milwaukee, Wis.—Permit was granted to the Electric Co., to erect a substation at 27th avenue and Burham street.

Neenah, Wis.—The council has decided to enter into a new lighting contract with the Wisconsin Traction Light, Heat & Power Co. The contract will provide for a larger number of lamps in the business district and less powerful ones in the outlying districts.

Superior, Wis.—The lighting system commission will petition for new white way in East End, Superior.

Wells, Minn.—City council is considering the construction of an electric power plant and distribution system and concrete reservoir. Engineer C. L. Pillsbury, Metropolitan building, Minneapolis.

Bloomfield, Iowa.—Citizens authorized officials to rebuild and repair municipal electric light and power plant. Address E. Z. Morrow, city clerk.

Ferguson, Iowa.—The question of establishing municipal lights will be submitted to vote. J. R. Finders, city clerk.

Humboldt, Iowa.—Northern Gas & Electric Co. contemplates extending its electric transmission lines from Ruthven to Lost Island Park.

Spencer, Iowa.—Spencer's municipal electric light and power plant will furnish electricity for power and lighting to farmers and several towns.

Butler, Mo.—Improvements for the electric light and water plant are contemplated.

Carrollton, Mo.—Harry A. Spradling and George A. Allen have purchased a substantial interest in the water, light and transit company. Mr. Spradling has been appointed manager and superintendent of the plant. The work of improving the plant is being rushed to completion. A 500-kw. engine and generator will also be installed to more than double the present capacity of the plant.

Edina, Mo.—Special reports have been prepared by experts on the proposition of placing a value on the light and ice plant. Improvements are also contemplated.

St. Joseph, Mo.—A new 10,000-kw. turbine with surface condenser is being installed in the plant of the St. Joseph Railway, Light, Heat & Power Co. The new equipment also includes two 1000-hp. boilers. G. W. Saathoff is the engineer in charge of the work.

Arlington, Kans.—Election will be held Aug. 1 to vote $20,000 in bonds for the purpose of purchasing, constructing and extending works for supplying the city with electric current. W. P. Barley, city clerk.

Elkhart, Kans.—Election to vote $60,000 additional bonds for the extension of the city water and electric light plant carried. It is planned to raze the old power house and erect

a much larger building in which will be installed an elaborate two-unit plant giving 24-hour service.

Hutchinson, Kans.—Elections are to be held at Arlington, Langdon and Turon to vote the necessary bonds for the building of transmission lines from Hutchinson.

Kansas City, Kans.—The Kansas City commissioners awarded the contract for generators for the municipal electric light plant to the Westinghouse Electric & Manufacturing Co. The cost of the generators will be about $232,000 and the contract calls for delivery in 90 days. Contracts for other machinery, boilers, poles, and necessary equipment have been awarded. The addition will double the capacity of the present plant.

Liberal, Kans.—A resolution has passed ordering the installation of a white way. The new street lighting system will extend about three-quarters of a mile.

Ness City, Kans.—Another engine and generator are needed for the light plant. These will probably be purchased in the near future.

Partridge, Kans.—Election will be held Aug. 1 to vote $20,000 in bonds for the erection of an electric transmission line and power plant by which that town can get current from Hutchinson.

Wichita, Kans.—Kansas Gas & Electric Co. will build a transmission line ten miles west of the city.

Woodston, Kans.—Election to vote $13,000 in bonds for the purpose of buying and improving the light and power plant carried.

Antler, Neb.—At a special meeting city council decided to enlarge the lighting capacity of the city electric light system. Address town clerk.

Hickman, Neb.—Plans being made by Grant, Fulton & Letton, Bankers' Life building, for an electric transmission line from Lincoln to Hickman and an electric distributing system to be voted.

Oshkosh, Neb.—Bond issue of $9750 for construction and equipment of lighting system to be voted. G. M. Robinson, clerk.

SOUTH CENTRAL STATES.

Springfield, Ky.—Plans are being arranged by the Springfield Water & Electric Co. for the installation of a quantity of new equipment at its plant, including alternators, engines, panel switchboards, etc. It is understood that the company is planning to convert the plant to the alternating current system.

Jackson, Miss.—The light and power plants, gas plant and other properties of Jackson Light & Traction Co., were purchased by M. H. Grossman, Milwaukee, Wis., representing the bond holders. The plants will be improved.

Meridian, Miss.—Board of Managers of the local Masonic Home is considering plans for the installation of a new electric lighting plant. E. J. Martin is superintendent.

Merigold, Miss.—Sage Brothers & Jones Construction Co., Memphis, Tenn., is erecting a school building. The electrical work on this contract will amount to $1300. M. M. Alsop, Randolph building, Memphis, Tenn., is the architect.

Lamar, Ark.—The City Council has given the Commonwealth Public Service Co. of Fort Smith a franchise and has entered into a contract whereby the latter company will furnish electric power for lighting and other purposes. The company will extend its main line from Jamestown to Lamar.

Marvell, Ark.—Marvell Light & Ice Co. has increased its capital stock from $20,000 to $40,000. A. V. Newman is president.

New Orleans, La.—Plans are being arranged by the Board of Managers of the Charity Hospital, for the installation of a new underground system to be used for the furnishing of electric lighting to about twenty buildings at the institution. Construction has been completed on the power house, and work will soon be commenced on the installation of the necessary equipment, including 300-kw., direct-connected, 3-wire generators, steam engines, motors, etc. The entire work is estimated to cost $90,000. A. Wyndham Lewin, 335 Carondelet street, is consulting engineer.

Comanche, Okla.—Election to vote $35,000 for improving the electric light plant, carried recently.

Gotebo, Okla.—City is having plans arranged for the construction of a new municipal electric light plant. Bonds to the amount of $20,000 were recently voted to cover the cost of the work.

Hobart, Okla.—The electric light bonds have been accepted and sold and work will commence at once on the new system.

Hydro, Okla.—A bond issue for the purchase by the city of the electric light plant and ice plant carried.

Tahlequah, Okla.—A bond issue of $200,000 has been authorized by the city officials, to provide for the construction of a new municipal electric power plant.

Beeville, Tex.—Improvements in the electric light plant are contemplated.

Breckenridge, Tex.—Texas Power & Light Co. will install new equipment.

Dallas, Tex.—It is stated by Fred A. Jones, engineer who is in charge of the surveys now being made for the proposed interurban electric railway that is to be constructed between Dallas and Wichita Falls that eight tentative routes have been gone over and that the preliminary survey of the ninth route is now being made. It will be left to the executive committee of the Dallas-Wichita Falls Interurban Co., as to which route will be selected. The distance by the shortest route is 130 miles. Glen Stiff, right of way agent of the construction company, is working in conjunction with the field engineers.

Fort Worth, Tex.—Investigations are being made to get information on different systems of street lighting previous to the improvement of the city system here.

Fort Worth, Tex.—Construction of the proposed interurban line to Mineral Wells will begin Oct. 1. H. E. Robinson, promoter of the company, that proposes to construct the line with the Palo Pinto county watering place and afford the isolated section of Parker and Palo Pinto an outlet to market their produce and crops. The line will extend 60 miles west of Fort Worth with prospects of it being constructed to the oil fields of Stephens county via Breckenridge and on to Ranger and Cisco. When incorporated it will be known as the Fort Worth & Western Electric Railway Co., and will be capitalized at $3,000,000. The company is headed by H. E. Robinson.

Luling, Tex.—A petition is being circulated asking that the Board of Commissioners order an election on city bonds in the sum of $75,000 for installing a municipal lighting plant and water plant.

Ranger, Tex.—Construction of a system of interurban electric railways through the Central West Texas oil fields is planned by the Ranger Light & Power Co., which has just been granted a franchise for a street railway system here by the city commission. The first of the interurban lines to be built will run between Ranger and Eastland, 12 miles. The company will construct a large central electric power station here.

WESTERN STATES.

Boise, Ida.—Mackay Light & Power Co. was given permission by public utilities commission to extend its lines down the Lost river to Arco. In this event it is probable that the town of Arco will not proceed with plans for a municipally owned power transmission line 46 miles long for which a bond issue of $60,000 had been planned.

Marshfield, Ore.—An estimate of what it will cost to put the power plant at the Smith Mill in good running order in relation to both the part which supplies the power for the Mountain States Power Co., and that which furnishes power for the Smith Mill, has been completed by the consulting engineer of the power company. The cost is estimated at $60,000.

Roseburg, Ore.—William Polman, owner of the local light and water plant who resides at Baker, Ore., was here recently inspecting the property with a view to making improvements. Pumping and power plant on the North Umpqua will be improved and entire system put in shape.

St. Johns, Ore.—Construction of electric railway connections between the municipal terminal at St. Johns and the city street car system may be undertaken by the public dock commission, as the result of an offer from the Portland Railway Light & Power Co. The cost of the connection is estimated at $25,000.

Bellingham, Wash.—E. F. Williams, engineer of Seattle, will investigate the feasibility of a plan to divert the South Fork of the Nooksack river into the Skagit river with the idea of installing a power plant of about 14,000-kw. capacity. He is the owner of the water rights on the South Fork.

Kelso, Wash.—Contract for the sub-

station at this place was awarded by the North Coast Power Co. to N. A. Strand, construction to start at once. The company also has a crew of men rebuilding the line from Kelso to Kalama to carry a load of 66,000 volts and a total outlay of $40,000 is being made by the company in this vicinity this summer.

Seattle, Wash.—Installation of an additional unit of 10,000-kw. capacity at the Lake Union Station plant will cost more than $75,000 according to estimates filed with the city council by J. D. Ross, superintendent of the city lighting plant who is urging immediate steps to meet what he says is a serious shortage of electrical power.

Seattle, Wash.—In connection with the proposed construction of the 18,000,000-ton capacity dry-dock at the plant of the Ames Shipbuilding & Drydock Co., large quantities of electrical equipment will be required, including complete electrically operated pumping apparatus, motors, etc.

Wenatchee, Wash.—Plans are being perfected by the Okanogan Valley Power Co. for the construction of a new dam and power plant on the Similkameen river, in the vicinity of its present works. It is understood that the proposed plant will have a capacity of 5000 hp.

Petersburg, Alaska — Citizens are organizing a company to install a hydroelectric power plant on Five Mile creek, to deliver power to the city. The City Council is to constitute the majority of the board of directors and the company is to issue bonds for $40,000, the estimated cost of the first unit of the plant, the bonds to be taken up by the city, which will become the owner of the enterprise. H. P. Crowther of Juneau is doing the engineering work.

Fresno, Cal.—Announcement has recently been made by the Pacific Telephone & Telegraph Co. that plans are now in process of formation for extensions in its cable system in the north and east sections of Fresno to be inaugurated during the coming fall. The work is estimated to cost about $55,000. Maynard Bailey is superintendent of the Fresno district.

Greenville, Cal. — Trask Copper Mining Co. has recently completed the construction of a new power line from Englemine to its local mining properties. Power for operation will be supplied by the Great Western Power Co.

Holtville, Cal.—Holton Power Co. is arranging final plans for the installation of new electric generating equipment in its dismantled power plant at Holtville. It is understood that the work is estimated to cost about $75,000. E. A. Judy is district manager.

Los Angeles, Cal.—Plans are being arranged by the Southern California Edison Co. for the installation of new generating equipment in its Big Creek plant No. 2, located about 240 miles from Los Angeles in Fresno County. In this connection the company will be obliged to construct an additional pipe line. It is understood that plans are under consideration for the installation of a similar unit in power plant No. 1 at a later date.

Los Angeles, Cal.—Large quantities of electrical equipment will be required in connection with the construction of municipal power plant No. 2, located in the San Francisquito Canyon, the entire installation being estimated to cost about $500,000. The machinery will include electric generating equipment, transformers, hydraulic equipment, and auxiliary electrical apparatus.

Los Angeles, Cal.—In connection with the proposed plant of the Keystone Iron Works, Merchants National Bank building, estimated to cost in excess of $100,000, large quantities of electrical equipment will be required, including three electrically operated cranes, motors, etc. The new works will be located on Santa Fe avenue.

Los Angeles, Cal.—Public Service Commission has approved plans for the installation of the proposed new ornamental lighting system on Broadway, to extend from California street to 10th street. The entire work is estimated to cost approximately $100,000.

San Diego, Cal.—The City Council is understood to have authorized the preparation of estimates of cost for the construction of a new municipal electric light and power plant, now under consideration. W. H. Judy is city manager of operation.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (29,921).—An electrical dealer in France desires to represent manufacturers of electrical goods in Brittany, except conduit, but particularly electric fans. Correspondence should be in French.

Electrical Equipment (29,931).—A merchant from France who is in this country desires to purchase from manufacturers only, for Roumania, iron and steel, and products, electrical goods, automobiles, rubber goods, agricultural machinery, machinery, hardware, electric railway cars and equipment for electric railways, glass and general merchandise. References.

Electrical Supplies (29,934).—A firm in this country is about to send a representative to Cuba to establish branch offices and desires to secure exclusive agencies from manufacturers of all kinds of hardware, tools, nails, roofing materials, railroad accessories of all kinds for tracks used on sugar plantations, dry goods, paper, special wrapping paper, electrical supplies, drugs and chemicals, and any merchandise that will find a ready sale in that country. References.

Vacuum Cleaners (29,933).—A firm in Belgium desires to purchase or to secure the agency for the sale of sanitary ware, heaters for bath, radiators, valves and accessories, and vacuum cleaners. Quotations should be given c. i. f. Antwerp. Payment, cash against bill of lading at Antwerp. Correspondence should be in French. References.

Electrical Goods (29,911).—A company in the United States composed of Americans and native Finlanders, who are going to send representatives to Finland, desire to purchase and secure the agency for the sale of all kinds of foodstuffs, wearing apparel, machinery, agricultural implements, electrical goods, etc. Reference.

Electrical Materials—Furnaces (29,945).—A mechanical engineer, graduate of an American university, will be in America to secure commission or consignment contracts for sale in Belgium of electrical material and supplies, metallurgical appliances, rolling mills, electric furnaces, ores, coal, etc.

Electrical Supplies (29,876).—The purchase by a company in Norway of electrical industry supplies, gas and electric fixtures, iron, steel boilers, various metals, shipbuilding materials, engines, electrical cable-making machinery, flour-mill machinery, motion-picture machinery, raw rubber, porcelain insulators and porcelain articles used in electrical industries, is desired. Terms, cash against documents. Reference.

PROPOSALS

Street Lighting System.—Bids will be received by J. W. Allard, city clerk, Osawatomie, Kans., until 8 p. m., July 28, for furnishing all material and installing a special street lighting system to consist of 102 metal lamp standard, steel topped and lead covered cable, street light switchboard panel, crossarms, pole-line hardware, No. 8 triple-braid waterproof wire and all appurtenances called for in plans and specifications, which may be secured at the office of the city clerk or the engineers, Black & Veatch, Interstate building, Kansas City, Mo. Contractors desiring plans will be required to deposit $10, $8 of which will be refunded when the plans are returned. Certified check $500.

INCORPORATIONS

Los Angeles, Cal.—Guaranteed Battery Equipment Co. has been incorporated with a capital of $25,000 to manufacture batteries, equipment, etc. T. S. Juden, H. M. Motzkus, T. O. Osborn, C. E. Corson, and Edward Corson, all of Los Angeles, are the incorporators.

Philadelphia, Pa. — Electro-Lyte Storage Battery Co. Incorporated under Delaware laws with a capital of $200,000 to manufacture storage batteries, etc. Incorporators: R. F. Hansell, Philadelphia; E. M. MacFarland, and J. Vernon Pimm, Camden, N. J.

Personal

E. C. Bennett Joins International Paint Corp.—Ervin Dryer Opens Sales Engineering Office—I. B. Zimman Promoted

HERMAN G. HARDY has assumed the position of chief mechanical and electrical engineer of the Arizona Copper Co., Ltd., Clifton, Ariz. He was formerly associated with the Old Hickory Powder Plant, Jacksonville, Tenn.

ROY PAGE, for the past two years associated with the Nebraska Power Co., has been appointed to the position of general superintendent, having direct supervision of the power station, purchasing department, garage, storeroom and the claims and welfare department. Prior to joining the Nebraska company Mr. Page was for some time connected with the Southern Pacific Railroad.

C. D. MCCLARY, who has been with the Western Electric Co. since February, 1910, has been made sales manager of the Pittsburgh office, effective July 1, 1919. Mr. McClary was first connected with the Philadelphia office and transferred to Pittsburgh in the latter part of 1910. In April, 1916, he joined the sales force, and in April, 1918, was promoted to the position of assistant sales manager, continuing in that capacity until his recent promotion.

I. B. ZIMMAN, manager of the sales and service department of the Nebraska Power Co., Omaha, Neb., has been promoted to the position of assistant general manager in charge of public relations. He will have supervision of the company's general relations with the public, franchises, municipal contracts, taxes and property assessments, reporting to the vice-president and general manager. Mr. Zimman has been connected with the Nebraska Power Co. and its predecessor, the Omaha Electric Light & Power Co., in various capacities for 17 years, principally in new-business work.

ERVIN DRYER has opened an office as sales engineer at 1535 Old Colony building, Chicago, and will handle steam, electric and hydraulic lines with an organization for doing the necessary engineering work in connection with the installation of such equipment. Mr. Dryer is one of the best known engineers in the Middle West, having had much to do with the design and construction of many of the most prominent power stations in this territory. He was graduated from the University of Illinois in the mechanical engineering class of 1887. He first became connected with the United States Electric Lighting Co., and when this company was taken over by the Westinghouse Electric & Manufacturing Co. he was made sales engineer in the Chicago territory. In 1904 he left the Westinghouse company to become a sales engineer in the Chicago district for the Allis-Chalmers Manufacturing Co., which position he had held continuously until the present time. Mr. Dryer is affiliated with a number of technical and engineering societies and has taken a very prominent part in the development of steam-electrical engineering.

ELL C. BENNETT, of St. Louis, has resigned from the office of seventeenth Mercury of the Jovian Order, to which position he was elected last October to serve until January, 1920, to join the International Paint Corp. in the capacity of secretary and general manager. This company, under the name of the Railway Supply Co., has been engaged in the production of paint

Ell C. Bennett.

oils, graphite and asphaltum paints for a number of years. Its capital stock has been increased to $150,000. The plant is located in East St. Louis, Illinois, with headquarters in St. Louis, and it will specialize in paints used in the electrical industry. Mr. Bennett served the Jovian Order for a longer period than any other elective officer in the history of that body, being elected for eight consecutive years. During his term of office the Order grew from less than 5000 members to nearly 20,000, the peak being reached just prior to the outbreak of the world war. Since that time the stress of war and changing conditions in the electrical industry have operated to materially reduce Jovian numbers.

L. W. W. MORROW, who has been at Yale University on leave of absence from the University of Oklahoma during the past year, is retained at Yale as assistant professor of electrical engineering. Professor Morrow was in charge of one of the divisions of the Signal Corps Training School for officer candidates while it was active. When at the University of Oklahoma Professor Morrow was director of the School of Engineering and took an active interest in public utilities of the state, particularly in connection with engineering and valuation matters.

Obituary.

GEORGE B. WEBB, capitalist and organizer of street railways and telephone companies, died July 7 at Baltimore at the age of 60. Mr. Webb began his business career with the Baltimore & Ohio railroad and subsequently in connection with Harry Parr he constructed the Baltimore & Northern railroad. Then with Alexander Brown & Sons, bankers, he consolidated the street railways of Baltimore, and for a short time was the president of the amalgamated companies. Mr. Webb's activities rapidly broadened. He organized the Maryland Telephone Co., the Pittsburgh & Alleghany Telephone Co., Wilmington Light & Power Co. and the Duquesne Light Co. of Pittsburgh. At a later period, with Baltimore associates, he consolidated the United Railways of San Francisco, and with Pierre S. du Pont and Harry P. Scott he consolidated the street railways and light and telephone system of Wilmington, under the name of the Wilmington & Philadelphia Traction Co.

BARON RAYLEIGH (John William Strutt), known as "Peter Shopkeeper" and as one of England's greatest physicists, died on June 30. He was born in 1842, a descendant of Sir Godfried Strutz de Winkered, who resided in Essex as early as 1240, and was graduated as senior wrangler at Trinity College, Cambridge, in 1865. From 1879 to 1884 he was Cavendish Professor of Experimental Physics in Cambridge University, and in 1887 he accepted the post of Professor of Natural Philosophy at the Royal Institution of Great Britain. He was awarded the Noble Prize for physics in 1904. Baron Rayleigh became well known throughout Europe many years ago by his papers on mathematics and physics, written under the name of "J. W. Strutt." The scope of the subjects treated in his essays was large and included such specialized subjects as chemical physics, theory of gases, flow of liquids, photography, optics, color vision, wave theory, and problems in the theory of electricity and magnetism. A characteristic of his experimental apparatus, which was designed and built by himself, was that it was unusually crude and unpretentious in appearance, but that it was essentially perfect and demonstrated his theory accurately. At the time of his election as Chancellor of Cambridge University in 1908, his reputation was such that it was said of him that "since the death of Lord Kelvin he is the most eminent chemist in Christendom."

For the Readjustment Period—What?

XLV.

The Banker's View

Bankers, no less than the public, are prone to form favorable impressions of men and affairs from their apparent vitality; and wholesome advertising certainly is an index to this condition.

Good advertising betokens business alertness, and that is a quality a banker always recognizes in his final summing up of credit.

Intelligent advertising gives the advertiser command of a broader and surer market, one less subject to the hazard of lost customers which a limited clientele imposes, and one less apt to be disturbed by a seasonal lethargy.

It scarcely seems necessary to assure any one, in these progressive days, that a banker looks with favor on his customers' advertising. The banker usually is the last man to take up an innovation. The fact that, over the country, the banks are heavy advertisers is the best evidence of the fraternity's attitude toward advertising.

S. A. FLETCHER
President Fletcher-American Co. (Bankers)
Indianapolis, Ind.

This extract from a letter addressed to James O'Shaughnessy, New York, who is Secretary of the American Association of Advertising Agencies, gives in a few words the views of all progressive bankers. Read the third paragraph again and reflect on it. How does it agree with your policy?

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

America Must Buy Foreign Securities.

It is felt in England that the combined effect of the recent prohibition of gold exports from that country and of the unpegging of sterling exchange, will bring about American investment in foreign securities, according to advices received from London by the National Foreign Trade Council.

British purchases in the United States cannot be paid for in gold and it will be a long time before British exports will rise to the point necessary to pay for imports. A way out is through private credits from the United States in the form of purchase of British securities.

Both the gold embargo and the depreciation of British exchange tend automatically to stimulate sales of English goods in foreign markets and to cut down her import purchases. She must still, however, depend on the United States for many commodities. It will probably be necessary for her to sell many of her securities in America if American goods are to move to any extent to Great Britain.

It is also suggested that America might help herself and support British industries at the same time, by establishing plants in the United Kingdom, the construction, machinery and total equipment for which should be purchased over there. In this way a market would be created for British goods and the gold would be kept within the kingdom. It is reported that large American businesses are already considering some such plan for establishing their product in the English and European market.

Doherty Bond Department Opens Consumers Ownership Branch.

The bond department of the Henry L. Doherty & Co. has opened a branch that will be devoted to the sale of securities of Cities Service Co. and its subsidiaries to the consumers of the organization's service. The work of this branch will be handled by L. F. Wiegand of the bond department.

For some time the Doherty organization has been considering the opening of this branch, realizing the opportunities and advantages of the sale of securities to the consumers of the products of Cities Service subsidiaries. The new branch will inaugurate an active campaign along these lines, and one of its main purposes will be the development and maintenance of good will between the consumers and the public utilities.

By becoming interested financially in the public utilities from which they purchase gas, light or street car service, the consumers are in a better position to understand the problems and financial requirements of the companies in their localities. The usual difficulties encountered in the maintenance of fair relations with the public are materially lessened. Practically all the advantages of public ownership are attained through such a partnership without the sacrifice of the greater advantages of private ownership that occurs when public ownership is substituted for private ownership.

Details of the operation of the Consumers Ownership Branch will be announced in the near future.

Allis-Chalmers Profits.

The report of the Allis-Chalmers Manufacturing Co. for the quarter ended June 30 will show a net profit, after all taxes and reserve for contingencies, of approximately $1,000,000. This compares with $966,000 in the first quarter and $1,183,755 in the corresponding period of 1918. Net of $1,000,000 is at an annual rate of $11 a share on the $26,000,000 common, compared with $11.06 in 1918.

Cities Service Bankers Shares.

Henry L. Doherty & Co. announce that the fifth monthly distribution on Cities Service bankers shares, payable August 1 to bankers shares of record July 15, will be 42.6 cents a share, comparing with 41 cents a share on June 2 and 42.8 cents a share on July 1.

Indianapolis & Louisville Traction Purchased.

The Indiana Public Service Commission has authorized the Interstate Public Service Co. to buy the property of the Indianapolis & Louisville Traction Co. This will give the Interstate Public Service Co. a direct line by ownership or leases from Indianapolis to Louisville. The Interstate Company acquired the I. & L. by paying $330,000 for the capital stock of the company and by assuming the $846,300 bonded indebtedness. The I. & L. property, consisting of 41 miles of interurban track between Seymour and Sellersburg, was figured in the sale at $28,700 a mile, or a total of $1,176,300, which is covered by the purchase price and the bonded indebtedness. The Commission also authorized the Interstate company to issue $31,200 bonds to retire a part of the $846,300 bonded indebtedness.

Duquesne Light Retires Notes.

The Harris Trust and Savings Bank, Lee, Higginson & Co., and Ladenburg, Thalman & Co., compose a syndicate of bankers which have sold the $25,000,000 of Duquesne Light Co. first mortgage and collateral trust 30 year 6% bonds to retire $10,000,000 of the company's 6% notes due July 1, 1921, which will be called for payment at 101 and interest, and also to provide the funds for the construction of a new power plant and other improvements. The bonds mature July 1, 1949.

Power Securities Company Formed.

In chartering the Powers Securities Co. of Concord, N. H., the State of New Hampshire has created the largest corporation ever organized in the State. Although its capitalization is not definitely fixed, except that the number of shares is set at 550,000, the State placed a valuation of its capital, for purposes of taxing the charter fee, at $27,500,000, and the charter authorizes the company to do business in gas, electric, water, and steam power development.

It is understood that New York financial interests are the promoters of the new company, and the actual incorporators are Robert C. Murchie, chairman of the Democratic State Committee of New Hampshire, Joseph W. Worthen, a son of Thomas W. D. Worthen, public service commissioner, and Thomas Hollis, a brother of Henry F. Hollis, former United States Senator. The president of the company will be H. P. Gibney, of New York City, and all the officers are New York City financiers, except the clerk, Mr. Worthen, of Concord.

Northern Indiana Gas & Electric to Issue Notes.

The Indiana Public Service Commission has authorized the Northern Indiana Gas & Electric Co. to issue $1,906,000 10-year 7% notes at par. The notes are designed to take up $955,300 demand 6% notes issued by the company and to take up $950,855 of an open 8½% account with its holding company, the United Gas & Improvement Co. The new note issue will reduce the fixed charges of the company $1720 annually.

Redemption of Standard Gas & Electric Bonds.

Philadelphia Trust Co., trustee, is advertising for the Standard Gas & Electric Co. 6% sinking fund gold bonds due Dec. 1, 1926, to absorb $74,615 in the sinking fund. The Girard Trust Co., trustee, is advertising for Western States Gas & Electric Co. first and refunding mortgage 5% gold bonds, due June 1, 1941, to absorb $60,111 in the sinking fund.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate Per cent.	Bid., July 8.	Bid, July 15.
Adirondack Electric Power of Glens Falls, common	6	15	15½
Adirondack Electric Power of Glens Falls, preferred	6	76	75
American Gas & Electric of New York, common	10+extra	130	132
American Gas & Electric of New York, preferred	6	41¾	42
American Light & Traction of New York, common	..	263	257
American Light & Traction of New York, preferred	6	98½	97
American Power & Light of New York, common	4	70	68
American Power & Light of New York, preferred	6	72	73
American Public Utilities of Grand Rapids, common	..	10	10
American Public Utilities of Grand Rapids, preferred	7	38	38
American Telephone & Telegraph of New York	..	104½	103¾
American Water Works & Elec. of New York, common	..	5	5½
American Water Works & Elec. of New York, particip.	7	11	11
American Water Works & Elec. of New York, first preferred	..	58	59
Appalachian Power, common	..	6	6
Appalachian Power, preferred	7	21	22
Cities Service of New York, common	+extra	410	440
Cities Service of New York, preferred	6	79¾	78¾
Commonwealth Edison of Chicago	8	112	112
Comm. Power, Railway & Light of Jackson, common	..	28	28
Comm. Power, Railway & Light of Jackson, preferred	6	62	62
Federal Light & Traction of New York, common	..	13	11
Federal Light & Traction of New York, preferred	..	50	59
Illinois Northern Utilities of Dixon	6	70	70
Middle West Utilities of Chicago, common	2+extra	36½	36½
Middle West Utilities of Chicago, preferred	6	60	60
Northern States Power of Chicago, common	..	71	71
Northern States Power of Chicago, preferred	ex. div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	64½	66
Pacific Gas & Electric of San Francisco, preferred	6	88	88
Public Service of Northern Illinois, Chicago, common	7	89	89
Public Service of Northern Illinois, Chicago, preferred	6	94	94
Republic Railway & Light of Youngstown, common	4	17	17
Republic Railway & Light of Youngstown, preferred	6	57	57
Standard Gas & Electric of Chicago, common	..	32	37
Standard Gas & Electric of Chicago, preferred	6	45	46
Tennessee Railway, Light & Power of Chattanooga, common	..	7	6½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	22	22
United Light & Railways of Grand Rapids, common	4	49	48
United Light & Railways of Grand Rapids, preferred	6	74½	75
Western Power of San Francisco, common	..	22	22
Western Union Telegraph of New York	extra	89½	88½
Industries.			
Electric Storage of Philadelphia, common	4	98	94
General Electric of Schenectady	8	165¼	171
Westinghouse Electric & Mfg. of Pittsburgh, common	7	57½	58¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	57	57